June 2008

PROMOTING OUTREACH PROGRAMMES AT THE ROYAL ARMOURIES AT HM TOWER OF LONDON

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An Interactive Qualifying Project Report submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfilment of the requirements for the Degree of Bachelor of Science

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Abstract

The project was a feasibility study for the Material Science Outreach Programme at the Royal Armouries at Her Majesty's Tower of London. The methods included cold-calling schools, sending out internet-based surveys through e-mail, and teaching material science outreach through the loan box programme in the classroom. The results include how to best contact teachers, a proposal for website design, and recommendations on how to best promote and utilise the programme in the classroom

Executive Summary

In the past decade, students in economically advanced countries have become less interested in pursuing higher education in the sciences. Some countries affected by this issue include the United States, the United Kingdom, and Egypt. In the United Kingdom it is not the lack of career opportunities that is causing students to become disinterested in the sciences. It is the lack of adequate, engaging, science-based curriculum resources available, and experienced science-teachers who can utilize those resources. One problem that is currently being addressed by the Qualifications and Curriculum Authority (QCA) is the lack of secondary school teachers with adequate experience in teaching the sciences. This directly affects the interest in the sciences of their students, if a teacher is passionate about a subject it can inspire their students, if they are apathetic that can also become their students attitude. The QCA in England has come under scrutiny for defining the curriculum too strictly, which has forced teachers into a regimented routine that fails to allow adequate time for learning. In order to help rectify this issue the QCA is releasing a new curriculum that is less structured, and allows teachers the opportunity to adjust the curriculum to meet the learning needs of their students.

Museums and educational sites are beginning to provide engaging programmes to help combat this problem. Many museums in England have been creating outreach programmes to keep students interested in the sciences. The Museum of Science, University College London, and the Royal Armouries at HM Tower of London are among these institutions with outreach programmes. Many museum programmes have evolved from actors doing performances to interactive programmes which allow students to be engaged and involved. Use of interactive programmes has steadily increased, because hands-on-learning has been found to be one of the most effective means of increasing student interest.

In February 2008, a group of Worcester Polytechnic Institute (WPI) students created a Material Science loan box for the Royal Armouries at HM Tower of London. The loan box consists of six experiments designed to teach children about Material Science, and connect it with the development of arms and armour. Our group arrived at the Royal Armouries at HM Tower of London to find that the programme had not yet been utilised by any schools. The

group was charged with determining the feasibility of the programme and how it may be changed to increase school use of the programme.

The group conducted a feasibility study, which utilised three methods of data collection which they based their recommendations for the future success of the programme. Interviewing other museums about their outreach programmes was the first method the group employed. Through museum interviews the group gained further insight into what makes a successful outreach programme, and what modifications may be beneficial to the Royal Armouries loan box. Secondly, the group utilised a email-distributed, internet-hosted survey, to contact and gain feedback from primary and secondary school teachers. The surveys provided valuable data regarding demographics, marketability, and general feedback regarding the programme. Finally, after identifying through museum interviews and survey data that the loan box may be feasible, the group took the loan box into the classroom to teach it as it was originally designed and interview teachers. By analyzing data from the classroom and teacher interviews, the group was able to create a list of recommended changes that could increase the effectiveness of the programme.

Interviews with other museums allowed the group to learn about what makes a great outreach programme. All museums that were interviewed had outreach programmes, but not all of them had loan box programmes. All of the museums that were interviewed approached their outreach programme in a unique manner, and were each able to provide different information that helped shape the project. One of the things the group learned, was that in order for a loan box programme to be effective and used, it must be unique. Additionally, the group learned that in many cases the cost of the programme itself is free; however, the cost of transportation is usually something the schools are required to pay for. If the programme is not unique and engaging, then teachers and schools will have no reason or desire to utilise the programme and spend money on transportation costs for it. Another key aspect the group found was that the more successful programmes were funded through outside sponsors, which allowed those programmes to be used by schools for free or at reduced cost. Another way other museums, such as University College London, reduced cost of the programme, was they require teachers to come pick up the box from them. While this is certainly an alternative to

charging for transportation, it limits the scope of schools they can service and provides other challenges, such as the lack of an individual who is familiar with the box to accompany it. The Museum of Science in London uses money procured from private sponsors to provide their programmes to less fortunate schools. Finally, all the museums stressed that developing and keeping a close relationship with teachers was integral to their programmes' success. E-Newsletters and mailings allowed museums to keep in touch with teachers and informed of new and upcoming programmes at the museums that may be of interest to them.

The second method of data collection for the feasibility study and recommendations was through internet-hosted, email-distributed surveys. The teacher surveys were attached to a database-driven email message, which utilised a database of 1000 teacher-email addresses each for both primary and secondary school teachers. With a response rate of an averaged 5.1%, teachers demonstrated a strong interest in both obtaining more information regarding the programme and utilising it in their classroom on the survey. This surprised the group, especially considering that the survey covered a vast area in Britain, and even schools far from the Tower demonstrated a strong interest. The surveys also showed that a large number of teachers would prefer someone to go with the box and aid in teaching it. This is partially due to many teachers lack of comfort with the concepts in material science, and also because an education officer could offer a cross-curricula component by bringing armour and armaments into the classroom. Additionally, many teachers expressed interest in having lesson plans provided with the loan box. This is again in part due to the lack of experience many teachers have with material science. A lesson plan also provides a starting point for teachers to base a lesson on and provides an overview of how the loan box is intended to be used. Additionally, the surveys provided valuable marketing information, which provided the group with a basic understanding of how and when the programme should be marketed to teachers. Since teachers require roughly six to eight weeks or more to incorporate the programme into their curriculum, the group found that the programme would greatly benefit from the use of tools such as e-newsletters to serve reminders about upcoming events at the Tower. Utilising the information received from the surveys, the group was able to establish recommendations for contacting teachers, keeping them informed, and ensuring the programmes use.

To complete our study of the loan box and increase its effectiveness, the group brought the Polymer box into schools to test it as it. The group experimented with various methods for explaining polymers to students. After teaching the first class the group re-evaluated their teaching plan, and found that lesson plans provided with the loan box needed to be tailored to different age ranges. The group also found the programme would benefit from being tailored to different curriculums depending on the time of year that teachers are looking to use the loan box. Additionally, coming into the Tower and meeting with Amy Preece (education officer at the Royal Armouries at HM Tower of London) would be essential to evaluating their needs and assessing how the loan box can best be fit into the concepts they are teaching. Amy Preece also has informed the group that she would also be willing to tailor the loan box to teachers' needs over the phone before sending it to them. This option would allow schools at great distances from the Tower the opportunity to utilise the loan box in their classroom. But, the group ultimately found that in order to best promote and encourage teachers to utilise the programme, education officers would need to assist in the classroom as well as ensure that the loan box is tailored to each teachers' needs who would like to use it.

The loan box programme is a great concept, which begins to address in part the need for interactive learning which encourages interest in the sciences. When the group arrived at the Royal Armouries at HM Tower of London the programme had been in existence for approximately three months, and had not yet been tested or used in a classroom. After surveying, interviewing, and testing the loan box, many positive outcomes have already resulted. A teacher from East Brook School, whom the group interviewed with, found out about the programme from the survey and has already booked a time in July. Amy Preece is going to meet with another school within the next month to discuss tailoring the programme to their schools needs and sending it to them.

Also, one of the questions from the survey asked whether the participant would like to be contacted about the programme in the future. Currently the group is providing the Royal Armouries with over 100 names and contact information of primary and secondary school teachers, who are interested and ready to use the programme. They will be contacted shortly after the feasibility study is completed in order to encourage them to use it within the next

school year. The feasibility study and some of the already implemented recommendations are already having an impact on the programme. The Royal Armouries has already booked the programme and is receiving e-mails to set up meetings with teachers to discuss using the programme. When the group was teaching at one school a teacher inquired about the possibility of setting up a training session for the whole science department and making it possible for them to utilise this programme on a regular basis. The study has provided the Royal Armouries with the tools to not only promote the programme, but to seek funding from independent sponsors to increase loan box programme's scope and turn it into a top-notch, widely-used, programme.

1 Introduction

It is surprising that in economically advanced countries, such as the United Kingdom, interest in the sciences is dropping. These countries have built their economies upon science and engineering. With a downward trend of interest in the sciences the economy is already suffering, which can be seen by the struggle to recruit qualified individuals for science and engineering jobs. In 2007, over fifty percent of companies believe that over the next four years they will not be able to recruit enough qualified technical and engineering staff, compared with forty per cent in 2006. (Brierley, 2007) It is not due to a lack of career opportunities that is causing student to become disinterested pursuing education in technology and science fields. Since students are no longer seeking degrees in these fields, the number of universities offering a BSc in chemistry has decreased by 23% over the last five years. Also, the Institute of Physics states that since 2001, 30% of university physics department have either merged or closed. (Chrostowski, 2003) If allowed to continue, this trend will cause companies in the United Kingdom to recruit an increasing number of foreign engineers.

In order to rectify this growing issue programmes are being developed to inspire children to become scientists. Hands-on learning has been an effective means of getting children involved and interested in the sciences. Students in a hands-on science programme are more likely to remember the material, feel a sense of accomplishment, and transfer the material between learning opportunities. (Haury, 1994)

To capitalize on the success of hands-on learning, many museums have created outreach programmes. The outreach programme at the Royal Armouries at HM Tower of London was created by a group commissioned in February 2008 from the Worcester Polytechnic Institute. The outreach programme consists of many experiments which teach the importance of materials in armour, and includes supplemental PowerPoint presentations and teaching manuals. (Burek, 2008) The programme is designed to address the growing gap between student interest in the sciences and the economies' need for scientists.

While the outreach programme has been created, it has not yet been utilised or publicized. The group who initially created the programme communicated with only thirteen schools. A follow up programme was not implemented and other avenues of promotion were not pursued. Currently there is little information about the outreach programme available to schools. Not only does a resource need to be provided to promote and educate about the benefits of the programme, but a feasibility study needs to be conducted to determine if the programme is viable.

The group will be conducting a feasibility study, which will be a compilation of teacher survey data, teacher interview data, student interview data, and museum interview data. Through these methods, the group hopes to have adequate data to determine whether the outreach programme is feasible as is, needs to have changes made, or isn't feasible.

The group will then finally assist the Royal Armouries in developing a plan to promote and utilise the outreach programme. The group plans to do this by developing recommendations on how to promote and utilise the programme in addition to refining the loan box teaching supplements and developing an information resource for teachers. By providing teachers with tools to use the outreach programme, we hope to aid the Armouries in furthering their mission to educate, encourage, and inspire interest in both the sciences and armament history in the United Kingdom.

2 Literature Review

In order to understand the problem that the Royal Armouries wishes to address, it is necessary to first understand the aspects of the declining interest in the sciences, museum outreach programmes, the teacher demographics, and education in the United Kingdom. In order to create a resource that provides the necessary information to assist teachers in learning about and utilising the outreach programme, the group needs a firm understanding in these areas. The group has achieved this by doing extensive research on outreach programmes at other museums, teacher demographics, and the United Kingdom's educational programming.

2.1 Declining Interest in the Sciences

While science is traditionally taught throughout the educational career of most children, including Foundation, Primary School, Secondary School, Further Education, and Higher Education, the level of interest in subjects dealing with the sciences has been steadily decreasing, and is a problem that they are seeking to change. (direct.gov.uk, 2008) After a fall in test results in the sciences, a spokesman for the Department of Education and Skills identified developing interest in the sciences as a priority. (bbc.uk.com, 2004)

Professor Colin Pillinger, a British scientist and leader of the Beagle 2 mission to Mars, remarked that he is fundamentally concerned with the "falling interest in sciences in schools." (bbc.uk.com, 2004) Additionally, the declining interest in the sciences has been quantified in England through the *Trends in International Mathematics and Sciences* Study (TIMSS), conducted in 2003. This study identified an average downward decline in the performance of students in the sciences.

One question the report asked students was specifically targeted at exploring student self-confidence in the sciences. Students were asked to respond to four statements: I usually do well in science, science is more difficult for me than for many of my classmates; science is not one of my strengths; I learn things quickly in science. An index, which placed the previous four questions on a ranked scale, was developed and utilised in quantifying the respondents'

answers. Students who responded with a more favourable answer, such as "I usually do well in science," ranked higher on the scale, and students who responded with a less favourable answer, such as "Science is not one of my strengths," ranked lower on the scale. English students ranked slightly above the international average on the scale, with 53% of students responding favourably and ranking highly on the scale, 32% ranking average on the scale, and 15% ranking at the bottom of the scale. Figure 1- Index of Students' Self-Confidence in Learning Sciences (TIMSS report), shows where English students rank in comparison to other nations. Considering that England is a developed nation, it is surprising that they do not rank higher on the scale. Less developed nations, such as Norway, Egypt, and Tunisia all have percentages over 60% of students ranking highly, which is considerably more than England.

Countries	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/ Integrated Science						
Tunisia	69 (1.1)	412 (2.0)	26 (0.9)	389 (3.4)	5 (0.4)	383 (5.0)
Egypt	64 (1.1)	452 (3.3)	33 (1.0)	389 (4.4)	4 (0.3)	354 (8.9)
Norway	60 (1.3)	512 (2.2)	30 (0.9)	475 (2.5)	10 (0.7)	456 (4.5)
Israel	59 (1.0)	515 (2.9)	31 (0.9)	458 (4.1)	9 (0.6)	452 (6.1)
Scotland	59 (1.5)	539 (3.3)	28 (1.1)	481 (3.5)	14 (0.9)	459 (3.9)
Saudi Arabia	58 (1.7)	418 (4.3)	36 (1.3)	378 (4.4)	6 (0.7)	366 (7.3)
Jordan	57 (1.0)	503 (3.3)	36 (1.0)	447 (4.4)	6 (0.5)	434 (10.2)
Italy	57 (1.1)	509 (3.2)	32 (1.0)	471 (4.1)	11 (0.6)	459 (5.2)
Ghana	57 (1.4)	294 (6.1)	36 (1.2)	224 (6.2)	7 (0.6)	173 (11.7)
Palestinian Nat'l Auth.	56 (1.1)	462 (3.3)	37 (0.9)	409 (3.8)	7 (0.5)	384 (6.5)
Bahrain	56 (1.0)	456 (1.9)	36 (0.9)	419 (2.3)	8 (0.5)	413 (5.3)
United States	56 (0.9)	548 (3.4)	31 (0.7)	507 (3.4)	13 (0.6)	495 (3.4)
Australia	49 (1.4)	550 (4.0)	34 (1.1)	513 (3.6)	17 (0.9)	499 (4.8)
Morocco	48 (1.6)	416 (2.9)	42 (1.7)	386 (3.5)	10 (0.9)	379 (6.9)
Iran, Islamic Rep. of	47 (1.1)	473 (2.5)	45 (0.9)	438 (2.7)	8 (0.5)	429 (3.5)
Botswana	46 (1.0)	391 (2.9)	44 (0.8)	353 (3.4)	10 (0.6)	337 (5.3)
Chile	46 (1.0)	434 (3.0)	44 (0.7)	393 (3.4)	10 (0.6)	407 (4.9)
Singapore	45 (0.8)	601 (4.4)	37 (0.6)	562 (4.9)	18 (0.6)	553 (5.0)
South Africa	45 (1.1)	282 (8.3)	46 (1.0)	215 (5.7)	9 (0.4)	207 (10.2)
[d] Philippines	43 (1.1)	408 (6.1)	52 (0.9)	359 (5.5)	5 (0.4)	334 (10.3)
New Zealand	41 (1.4)	548 (5.7)	41 (0.9)	509 (5.2)	19 (1.2)	489 (5.4)
Malaysia	38 (1.2)	530 (3.9)	48 (1.0)	500 (3.5)	14 (0.6)	496 (4.7)
Hong Kong, SAR	32 (1.1)	582 (3.3)	47 (0.8)	546 (3.6)	21 (1.0)	540 (2.9)
[a] Chinese Taipei	28 (1.0)	616 (3.3)	38 (0.7)	560 (4.3)	34 (1.1)	548 (3.3)
Korea, Rep. of	20 (0.7)	612 (2.2)	42 (0.7)	556 (2.0)	38 (0.9)	533 (2.1)
Japan	20 (0.9)	595 (2.7)	46 (0.8)	551 (1.8)	34 (1.0)	529 (2.3)
[‡] England	53 (1.5)	569 (4.9)	32 (1.3)	525 (5.2)	15 (0.9)	513 (6.3)
International Avg.	48 (0.2)	490 (0.8)	38 (0.2)	445 (0.9)	13 (0.1)	430 (1.2)
Benchmarking Participants						
Basque Country, Spain	50 (1.8)	513 (3.5)	34 (1.2)	469 (3.4)	16 (1.2)	455 (4.6)
Indiana State, US	53 (1.8)	554 (5.0)	31 (1.0)	512 (5.1)	16 (1.3)	495 (5.9)
Ontario Province, Can.	52 (1.5)	553 (2.8)	34 (1.1)	517 (2.9)	15 (1.0)	497 (4.7)
Quebec Province, Can.	50 (1.7)	551 (3.4)	31 (1.1)	518 (3.7)	19 (1.2)	503 (3.2)

Figure 1- Index of Students' Self-Confidence in Learning Sciences (TIMSS report)

While the previous measure of student self-confidence in science is surprising, the study went further and explored whether or not students value the sciences. Only 38% of Students in

England were highly interested in the sciences. This is nearly 45% below countries such as Egypt, Jordan, and Ghana. (TIMSS, 2003)

Students who enjoy learning science in England are at an incredible low in comparison to the international community, ranking nearly 7% below the United States. (TIMSS, 2003) The level of interest and desire to learn science in England has declined below the international average, and substantially below countries of similar international prestige and wealth. With an education system that includes a strict curriculum and rigorous educational quality assurance, it is difficult to predict why England is failing to educate and generate interest in the sciences.

Possible reasons for a decline in interest range from an increased rigor in science and math curricula, to inadequate availability of science and research facilities, to a negative perception of the sciences. (Predazzi, 2005) England has already instituted new programmes and ideas to aid in developing a greater interest in learning about the sciences and becoming a scientist. By developing new programmes to encourage students to pursue careers in the sciences England can continue to be a formidable force upon the world stage.

In order to combat the declining interest in the sciences, many programmes have been developed. Outreach programmes have been identified as one possible method for addressing the issues regarding science education and interest (Bury, 2005). This is one of the newest methods the Royal Armouries is employing to aid in generating interest in the sciences.

2.2 Museums and Outreach Programmes

Museums offer a unique tool to help students learn. Museums are an informal, voluntary method for learning information which is “driven by curiosity, discovery, free exploration and the sharing of experiences with companions”. (Screven, 2008) Museum learning creates curiosity and interest that can extend into the classroom. In 2003, a group of 300 children aged 10-11 were brought to the UK national Space Centre. After the visit, 22% of the male and 27% of the female students showed a significantly greater interest in becoming a scientist. This increased interest in the sciences could still be seen months later. Of the 300 students originally surveyed, 18% of the male and 22% of the female students showed a significantly greater interest in becoming a scientist after a five month period. (Jarvis, 2004)

To increase student interest in the sciences, many American museums have developed outreach programmes. These outreach programmes offer a cost-effective alternative to visiting the museum. Although these programmes vary in content and type, they all serve to promote interest in the sciences.

One American museum that has an outreach programme is The Higgins Armoury Museum. This programme consists of a one-hour long session in which an Education Interpreter uses reproduction arms and armour to teach about a chosen topic. One topic The Higgins Armoury Museum offers is *A Knights Tale*, which "describes the evolution of arms and armour from the mail hauberk of Charlemagne to the full plate tournament armour of the court of Maximillian I." Another topic is *Pike and Shot: The Decline of Armour*, which discusses the "birth of modern warfare" by demonstrating equipment from the era. The outreach programme costs $375 for one performance and $275 for any additional performances on the same day at the same location. There is also a $0.85 per mile, roundtrip, and an extra fee of $50 for locations beyond 250 miles round trip. (Higgins Armouries, 2008)

The Boston Museum of Science also has many outreach programmes. One of their outreach programmes is *Weather: Wind, Water & Temperature*. This programme, meant for grades 3-5, teaches children how "air, water, and heat interact with each other to create weather". Another programme is *Cryogenics: heat and temperature*, which teaches students about heat and energy transfer. The Boston Museum of Science does not mention the price of using the outreach programme on their website, but does mention that scholarships are available. (Boston Museum of Science, 2008)

The University College London Museum has a series of outreach programmes that cover topics from Ancient Greece to Citizenship & Identity, and can be used to teach up to 19 year old students. One topic is *Ancient Greece* which gives students the opportunity to hold artefacts such as perfume pots and jars, and decorated pieces of pottery. The UCL museum has set up a website to give a short overview of what the loan boxes contain. To borrow a loan box, schools must contact the Education and Access Officer at UCL, where they will also receive advice on how to work the loan box programme into their curriculum. The loan boxes can be borrowed free of charge for half a term. (UCL, 2008)

The London Science Museum also has a well developed outreach programme. The museum has Science Storytelling sessions, Workshops for students and adults, and Science Shows. Science Storytelling sessions use classical children's stories, such as The three Little Pigs, to teach FS and KS1 students about science. Workshops are mainly for KS2 and teachers. Workshops are about a given subject. For example, the Workshop *Hot-Air Balloons* is a workshop about the history and science of hot-air balloons with a focus on forces and materials. Science Shows are made for larger groups and are science demonstrations. The programme's cost £350 per school day. (London Museum of Science, 2008)

2.3 History of the Tower of London

The Tower of London, more formally known as Her Majesty's Palace and Fortress, is located on the north bank of the River Thames in the borough of Tower Hamlets. It has served London as a prison and place of execution, armoury, treasury, zoo, Royal Mint, and home of the Crown Jewels. The Tower of London currently houses the Crown Jewels and many other notable historic artefacts, such as King Henry VIII's armour, and is one of London's biggest tourist attractions with more than 2.5 million visitors annually. (Imboden, 2008)

In 1078, William the Conqueror began work on the White Tower, the original and most identifiable portion of the Tower of London, which was to serve as his palace. The White Tower was later fortified and expanded by subsequent monarchs to encompass the fortress that is present today. (history.uk.com, 2008) The Tower of London is probably best known through history as a royal prison and execution site. Many notable figures in British history including several of King Henry VIII's wives were beheaded there.

The Tower of London has always been home to the Royal Armouries, with weapons first documented in the reign of King John (1199-1216). By 1327, the Tower had become the primary storage location for arms for the English army and navy.

Prior to 1660, the Tower was only open to important visitors by special permission. After 1660, the tower was opened to the paying public as a display of the English Monarchy's power and wealth. Beginning in 1696 a new addition to the Tower, the Grand Storehouse,

housed two additional exhibitions: The Small Armoury and the Line of Kings. However, due to a catastrophic fire in 1841, most of the material in the Small Armoury was destroyed.

The Royal Armouries at the Tower of London is the oldest museum in Britain today, and one of the oldest in the world. Many of the collections that were formally held in the Tower of London have been moved offsite to locations in Leeds, Fareham, and Louisville, Kentucky. This has allowed the Royal Armouries at the Tower to focus on the arms and armour that directly relates to the Tower. The Royal Armouries is currently responsible for all the displays in the White Tower, as well as for recording and keeping the official history of the Tower of London. (Royal Armouries, 2008)

The Tower of London to this day remains an icon of British history and national identity, displaying the incredible power and might of the British armed forces. Although it is no longer utilised as a royal residence, there are many exhibits housed at the Tower. The Tower of London aims to educate and inspire pride in British history.

2.4 Royal Armouries Outreach Programme

The loan box programme is a relatively new concept that the Royal Armouries has adopted to reach out to students in the community. A loan box is literally a package that contains a series of experiments, which in this case exemplify the relationship between material science and armour throughout history. The concept was developed in an effort to provide supplemental material for the curriculum. Also, the programme provides teachers and students who can't visit the Royal Armouries a means of experiencing what the Armouries has to offer. The Royal Armouries has developed the loan box programmes to assist teachers with hands on learning related to material science. Through the loan box programme the Royal Armouries is seeking to address the issue of declining interest in the sciences by involving children through hands on activities.

The polymer loan box was created in February of 2008 for the Royal Armouries. This box contains six experiments, which fulfil requirements of the national curriculum and is designed to be entertaining to children of various ages. In order to graduate from secondary school, standardized tests are given to ensure that the curriculum is being met. There are four major General Certificate of Secondary Education exam boards, the Qualifications and Curriculum

Authority (QCA), Oxford Cambridge and RSA Examinations (OCR), Assessment and Qualifications Alliance (AQA), and Edexcel. In Appendix A: Polymer Loan Box Educational Fulfilments, each experiment is shown how they fulfil requirements for these various boards. The polymer box is supplemented by teacher aids including a PowerPoint presentation and a printed teaching manual.

The second loan box is the metals box which was created by the Royal Armouries in March of 2008. The contents of this box are a teacher pack, an intro pack, and a series of experiments. The teachers pack includes a list of equipment, rules of use, whiteboard activities, and resources that can be photo copied and used by teachers. The intro pack contains examples of various pieces of metal that have been extracted from ores, iron extraction objects, and magnets. Finally, there are three experiments to promote hands-on learning. The first involves calculating displacement, the second relates to acid and metals, and finally there is a teacher led experiment dealing with heat and metals. These three packs of the metals box ensure teachers and students fully utilise the metals programme.

Figure 2 Left: Metals box; Right: Polymers box

2.5 Education in the United Kingdom

The school system in Europe up until high school is equivalent to the school system in the United States. For most primary and secondary educational facilities the school year begins the

first week of September and ends the second week in July. Throughout the school year there are various bank and religious holidays that are given as vacation days. Pictured in Table 1 is an example calendar for the 06-07 year from the Eurydice, written and published by the European Commission. (Europe Commission, 2006) The similarities between the U.S. and U.K. school system ensure that while the project is being worked on in London, school will be in session and teachers will be available to survey. It also presents the opportunity to promote the outreach programme during a time where the schedule and budget may be produced for the following year, hopefully creating demand for the use of the outreach programme.

Organisation of school time in primary and general secondary education 2006/07 school year	
Starting date 2006	First week of September
Autumn 2006	1 week 23 – 27 October
Christmas/New Year 2006/07	2 weeks Between the third or fourth week of December and the first week of January
Winter/Carnival 2007	1 week 12 – 16 February or 19 – 23 February
Spring/Easter 2007	2 weeks 02 – 13 April
Third term 2007	7 weeks 28 May – 01 June
Summer 2007	6 weeks Between 23 July and the first week of September
Public/religious holidays 2006/07	7 public holidays 01/05 (School holidays in England and Wales are planned to take into account and cover other national public holidays)

Source: Eurydice

Table 1 Organization of school year in England

When visiting and evaluating data from schools, the group wanted to ensure that the data came from similar sources. As in the United States and many of the other European countries, schools can be differentiated by where their funding comes from. However, England differs from the greater part of Europe in their terminology used to describe their schools. In the United States there are private schools and public schools, which are defined by their source of funding, very rarely private schools are referred to as independent schools. This can also be said for England, but instead schools supported by tuition are referred to as independent schools, not as private, and schools supported through government funding are referred to as either a state school, local authority school, or foundation or community school.

(British Council, 2008) This can also be said for England, but instead schools supported by tuition are referred to as independent schools and schools supported through government funding are referred to as either a state school, local authority school, or foundation or community school. (British Council, 2008)The types of schools that will be focused on are the government funded state schools. The outreach programme was created to fit into the National Curriculum's requirements, which independent schools do not have to follow, and are free to educate how they wish. (Training and Development Agency for Schools, 2008) A majority of the education provided in England is from state schools, and they are the primary target of the outreach programme. (British Council 2008)

The schools in England are also governed by the National Curriculum of England which is funded by the Department for Children, Schools, and Families (DCSF). DCSF also funds the Qualifications and Curriculum Authority (QCA), which "maintain[s] and develop[s] the national curriculum, and associated assessments, test and examinations. A subsidiary of the QCA is the National Assessment Agency (NAA) which is charged with the duty of safeguarding and modernizing the delivery of exams, tests, and assessments."(National Assessment Agency, 2008) The newest curriculum is to be implemented from 2008-2011. The QCA re-evaluates the curriculum every three years and then changes it according to audits done in the classroom and the changing needs of children. (Qualifications and Curriculum Authority, 2008)

The National Curriculum contains four keys stages. Examining science, key stage one is roughly from the ages of five to seven. (Usbourne.co.uk, 2008) During this stage pupils use their senses to make observations and also begin to communicate what they learn using scientific language and visual aids. (National Curriculum: United Kingdom, 2008) Key stage two encompasses children from ages seven to eleven. (Usbourne.co.uk, 2008) Pupils learn more about life sciences and begin to use more advanced models to express what they are learning. They also begin to think about the ramifications of science and technology in the environment, as well as learn how to research. (National Curriculum: United Kingdom, 2008) Key stage three targets children from ages 11 to 14. (Usbourne.co.uk, 2008) While still applying all the tools they have acquired before this stage, pupils begin to evaluate different opinions and expand their research works. They also begin to perform more quantitative work, carrying out

experiments of their own and learning how to present them. The final key stage in the National Curriculum is key stage four which encompasses ages 14 to 16. (Usbourne.co.uk, 2008) In this stage the students begin to evaluate the impact that technology and science have on the world and work on how to counteract them. At this stage, students should be able to express themselves well with regard to scientific language, visual aids, and research. It is necessary to understand the key stages in order to integrate the outreach programme into the curriculum.

The two key stages relevant to this project are key stages two and three. The metals box is intended as a transitional tool for children at the upper end of key stage two, headed into key stage three, and the polymers box targets key stage three and four children. The science programme is split into four sections, scientific enquiry, life processes and living things, materials and their properties, and physical processes. These are taught at every key stage, but different aspects are emphasized. During Key Stage two in material science children learn how to group and classify material, learn how to change materials, and separate mixtures of materials. These include properties such as conductivity, thermal insulation, and being able to describe and group rocks on the basis of their characteristics. Also, they should be able to realize the difference between phases, and relate them to ease of flow and maintenance of shape and volume. Children in key stage two are also required to be knowledgeable in the ways that materials can change and whether or not these changes are reversible and why. Finally, they are taught about solutions, evaporation, and how to manipulate different mixtures of phases into separating (National Curriculum, 2008).

Key stage three also has the same four principle topics, but the material science section delves deeper into what is behind all the concepts learned in key stage two. Children at this point should also be learning how to classify materials with a focus on two sub-subjects which include solids, liquids, gases, elements, compounds, and mixtures. Initially the subject is how to characterise materials, and how particle theory can explain the behaviours of materials. Following that children are taught about elements in the periodic table, how elements vary in their physical properties, how to combine these to create chemical reactions and denote them with appropriate equations, and how to separate mixtures using more advanced chemical procedures such as distillation and chromatography. To cover the subject of changing materials,

three sub-subjects are taught; physical change, geological changes, and chemical reactions. Physical changes covers topics such as when a physical change happens mass is conserved, the variations that environmental factors can have on solubility, and how to relate changes of state to energy transfers. Next, geological changes include lessons on how environmental factors affect rock processes. Thirdly, to learn about chemical reactions the topics discussed include mass conservation in chemical reactions, living everyday chemical reactions, and the impact that fossil fuel consumption is having on the environment. The last topic covered in the material science curriculum is pattern of behaviour. This is again split into two sub-subjects, metals and acids and bases. First, metals are taught using concepts including how metals react with different substances, the displacement reactions between metals and solutions, and how to use the results of these reactions to predict the results of future reactions. Finally, children are taught about acids and bases using indicators to classify solutions into categories, how metals and bases react with acids, how acids can lead to corrosion of metals, and to identify the patterns in these chemical reactions (National Curriculum, 2008). The group needs to understand these two specific key stages in order to properly understand how these programmes will fit into the curriculum.

2.6 Teachers Demographics

Teacher demographics are an important aspect of the project. The outreach programme and teacher resources must be designed to accommodate the needs and abilities of teachers. These needs and abilities can be predicted by factors such as age and sex. (Kotler,1998) Also, the teacher demographics can be later compared to any surveying that the group does to ensure that an accurate representation of the teaching population is reached.

In September 2007, the department for children, schools, and families released a compilation of statistics on England's school workforce. The report states that there are 216.8 thousand secondary school teachers working in England. (Department for Children, Schools and Families, 2007)

The National Foundation for Educational Research also conducted a survey to find the age range of science teachers. Teaching age in the UK follows a bell curve (see Figure 3). Most

science teachers are between the ages 25-59, with the largest percentage being between the ages 30-39. (Higgins, J., & Taylor, M., 2007)

Life Long learning published a report based on the 2005-2006 school year, analyzing England's scholastic workforce. The report states that there are 78 thousand female teachers, with four thousand working in the sciences and mathematics. There are also 54 thousand male teachers, with four thousand working in the sciences. (Lifelong Learning, 2007)

As with any programme, in order to effectively promote and market, a full understanding of the target demographics is needed. Additionally, any surveying of the target demographic must be an accurate representation of the demographic population. These teacher statistics will be used to ensure that the data gathered by the group is accurate, applicable, and can be used to determine the feasibility of the programme.

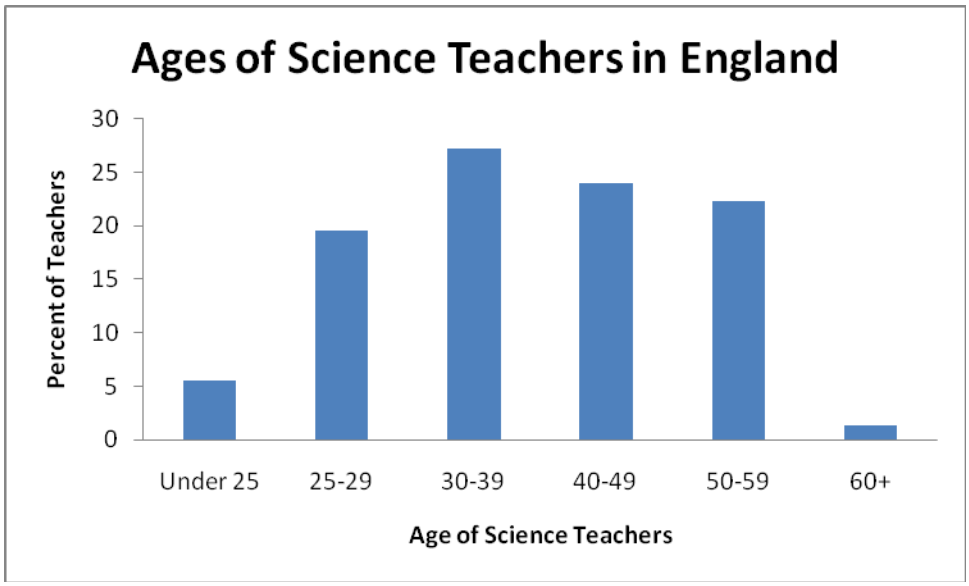


Figure 3 Size of science teacher age groups

2.7 UK Internet Usage Demographics

Since the internet was the groups' primary means of contact with teachers, it was important to understand what age groups use the internet and how this could affect the results. Internet usage in the UK is fairly prevalent with over 15.23 million households having access to

the internet in 2007. (Pollard, 2007) This means that 61% of UK households have access to the internet.

In the UK, internet usage decreases gradually with age. This can be seen in Figure 4, where 28% of people that have used the internet in the past three months were 16-24 years of age. Then, 24% UK residents that have used the internet in the past three months are between 25-44. This trend continues to 7% of UK internet users at 65 and older. (Pollard, 2007)

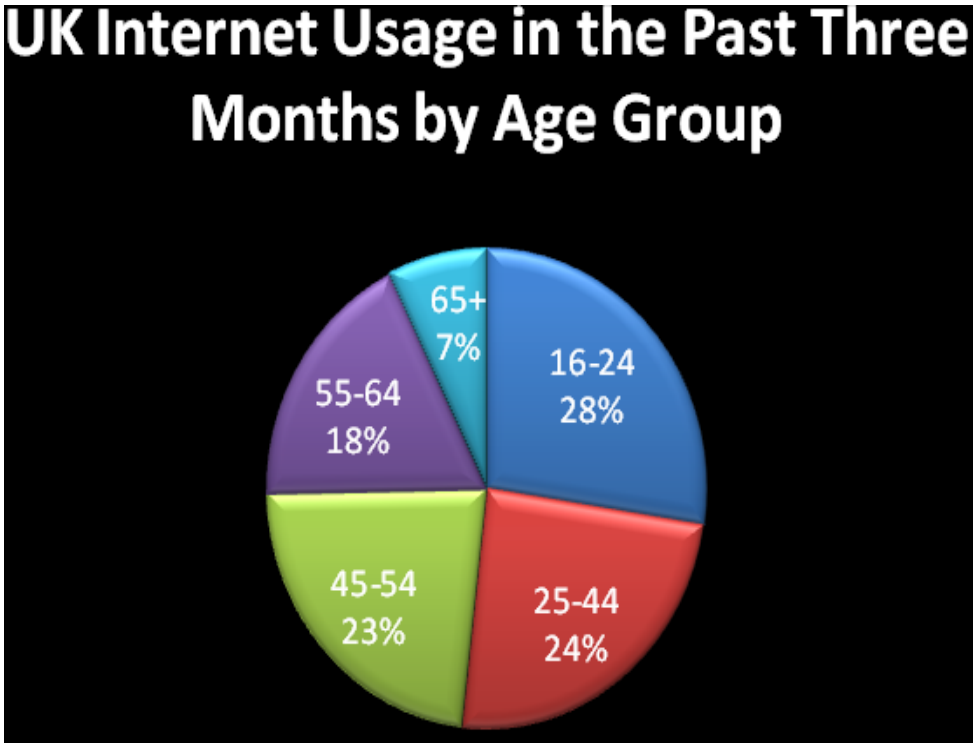


Figure 4 UK Internet usage in the past three months by age group

The hours spent utilising email each day also varies with age. Younger people, between 16 and 44, tend to use email every day. Where as older people are more likely to use it less than once a day. (Pollard, 2007)

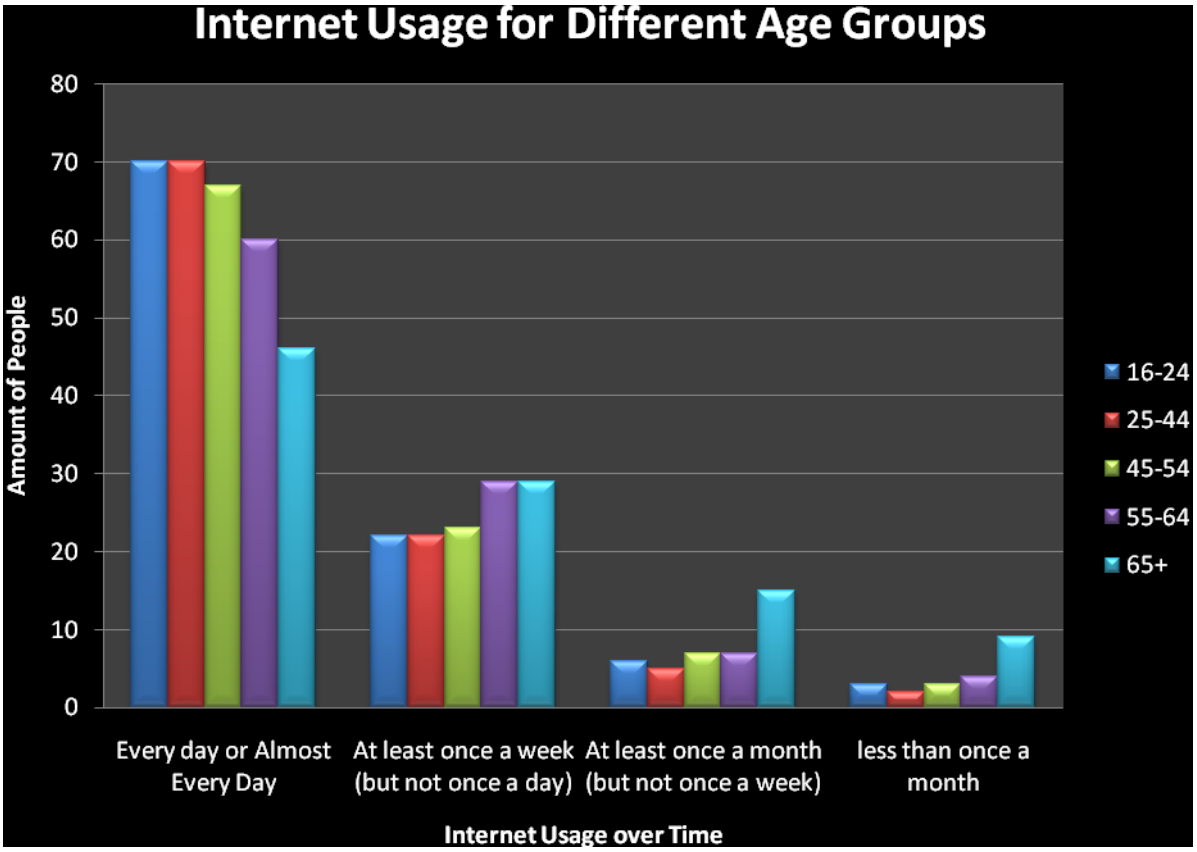


Figure 5 Internet usage for different age groups

2.8 Conclusion

The declining interest in the sciences in developed nations is a growing problem. Museums are striving to meet the needs of students and teachers by encouraging hands on learning. Hands-on learning has proven to be one of the most effective means of learning available today. (Haury, 1994)

The Royal Armouries is home to one of the largest and oldest collections of armour and armaments in the world. Through their Materials Science Outreach Learning Zone outreach programmes they are not only seeking to help in fighting the declining student interest in the sciences, but to encourage, inspire, and teach the importance of materials in the development of armour throughout history.

The outreach programme at the Royal Armouries was created in February 2008 and is still in its infancy. In order for the programme to be effective, teachers must both be aware of the

programme and want to utilise it in their classroom. The outreach programme must be effectively promoted and integrated into the curriculum to ensure teachers utilise the programme. When effectively promoted and utilised, the outreach programme has the potential to aid in encouraging students to become scientists and engineers.

3 Methodology

The following section outlines the mission and goals for the project. Additionally, this section describes the methods for how the group intends to successfully accomplish the objectives.

3.1 Introduction

The mission of our project is to assist the Royal Armouries in determining the feasibility of their Material Science Loan Box Programme.

Our objectives to accomplish the mission are:

1. To determine the feasibility of the Materials Science Loan Box Programme.
2. To identify how and when the Material Science Outreach Programme will best be utilised in the curriculum
3. To identify the most practical options for use of the loan box programme; either in conjunction with visiting the museum, or in lieu of visiting the museum.
4. To make recommendations on how to best market the loan box programme
5. To design a website to promote and provide resources for teachers.

The group placed few restrictions on the feasibility study, and attempted to incorporate the greater part of the educational community in the results. Restrictions that did exist were: the hours of contact teachers were available to contact and the key stages the group was able to target with the surveys. The following sections describe the methods we have adopted to achieve each of the objectives listed above.

3.2 Feasibility

To help the Royal Armouries' increase the usage of their new outreach programme, the group developed ways which the Royal Armouries could encourage teachers to use the programme. Many museums in both the United States and England have successful outreach

programmes. Meeting with these museums allowed the group to see how successful various outreach programmes were and what makes them successful.

3.2.1 Outreach Programme Interviews

In order to determine the feasibility of the programme, one method the group employed was interviewing museum curators in the Massachusetts area. Meetings with the curators of the Boston Museum of Science and the Higgins Armories were completed before travelling to London. Once the group arrived in London, they met with the University College London Museum's as well as the London Science Museum's outreach coordinator to discuss their outreach programme. This meeting ensured that any information the group gathered from United States based museum outreach programmes could be successfully applied to United Kingdom based outreach programmes. These interviews enabled the group to further understand how museums encourage teachers to use their programmes.

The group asked both qualitative and quantitative questions. Asking open-ended qualitative questions allowed for a better understanding of the museum's outreach programme. Quantitative questions dealt with statistics of the outreach programme such as the number of participants per year. (Patton, 2001)

There were many options for the structure of the interview, with there being three primary ways interviews are traditionally structured. The first way is an informal, conversational interview. This method has no predetermined questions; interviewers "go with the flow". This interview type is not well suited for gathering information which can be standardized, and would not have been well suited to gathering the information the group required from the interviews.

Another method is a standardized, open-ended interview. This method uses predetermined questions to ensure that all museums are asked the same questions. While this would provide the group with a method to compare the outreach programmes, it would not allow the group to ask follow up questions outside the standardized questions. This method would cause the group to leave the interview with an incomplete knowledge of their outreach programme.

The last method is to use a general interview guide approach. This method does not use a predetermined list of questions, but rather employs a predefined number of areas that should be covered throughout the interview process. The general interview guide approach allows some freedom during the interview, while still providing a smooth interview environment. This method was best suited for the group, since it allowed the group to gain an in-depth knowledge of the museum's outreach programme while ensuring that any information gathered from one interview could be compared with the information from another. (McNamara, 2008)

There were three types of questions that the group could ask during the interview: unstructured questions, semistructured, and structured questions. Unstructured questions allow the respondent, rather than the interviewers to decide upon the focus of the question. The group used this type of question sparingly since it would be difficult to compare the answers to these types of questions. Semistructured questions still allow the respondent freedom with answering the question, but not as much freedom as an unstructured question. Semistructured questions tend to ask about more specific areas than unstructured questions. They were used most often during the interview since they ensured comparable results, while allowing for the respondent to elaborate on their answers. Structured questions are very specific and rarely open ended, thus reducing the amount of freedom the respondent has in answering the question. Structured questions are usually not open-ended. (Merton, 2008)

The interviews were structured carefully, to ensure that they went smoothly. Additionally, the group interspersed factual questions through the interview, to avoid asking them all at once. This ensured that the interviewee stayed engaged throughout the interview. Also, since it is generally easier to answer questions about the present, the group asked questions about the present before questions about the past or future. (McNamara, 2008)

To gather information during the interview, an audio recording was taken with the interviewees' permission and a group member took notes on what was said. This system ensured that all information gathered during the interview was recorded for accuracy. Right after the interview, the group ensured that the recording worked through the interview as well as went through the notes from the interview to ensure they were complete. (McNamara, 2008)

Lastly, once the interview was completed the group discussed what form of follow-up to do with the interviewee.

3.2.2 Evaluation of Other Outreach Programmes

Interviews with representatives from other outreach programmes allowed the group to evaluate the best way to promote the Royal Armouries at HM Tower of London's outreach programme to teachers. From interviews with representatives from other outreach programmes, such as the Higgins Armories and Boston Science Museum, the group determined the best way to integrate the outreach programme into classrooms in the United Kingdom. The assumption was made that a method for integrating an outreach programme into the curriculum of a United States school would be similar to integrating one in a United Kingdom school. The group tested to make sure this assumption was true by interviewing representatives from local museums, including the Museum of Science in London and University College London that have similar programmes.

3.2.3 Evaluation of Current Polymers Box

The group planned to do a trial run of the polymer box in a formal classroom setting. A lesson plan was created to show the teacher how the group planned to run the class. The lesson plan provided structure for the lesson, and was invaluable to the group since no members had previous experience with teaching. First, interviews were performed with a current and former teacher who had knowledge of the loan box. Second, the experiments were performed by members of the group, to allow the group the opportunity to try them out and ensure that they worked. Finally, the booklet and information provided in the box was evaluated in relation to the two steps prior. By using the knowledge obtained in the interviews and performing the experiments the group evaluated the proposed lesson plan set forth in the polymer box currently.

3.3 Curriculum Integration

An important aspect to promoting the outreach programme at the Royal Armouries is curriculum integration. In order to encourage schools to use the programme it needs to be shown that the outreach programme fits into the curriculum. Also, the programme needs to be

tailored to teachers' needs and desires. By integrating the outreach programme into the curriculum and tailoring it to fit teachers' desires, the group hopes to encourage the regular use of the outreach programme.

3.3.1 Teacher Surveys

The loan box programme will be primarily utilised by teachers in place of traditional curriculum to teach science. In order to ensure the programme is tailored to teacher's needs, the group used a variety of methods to learn what teachers wanted from a loan box programme. A mass email to the head of secondary schools in England, as well as a small number of science departments was sent. This allowed the group to survey teachers about what they would like to see in an outreach programme and gauge their interest in the Royal Armouries loan box programme. The group also attempted to meet with teachers to conduct in person interviews about the Royal Armouries new loan box programme.

The first step was to directly survey teachers. There were two ways to choose the survey demographics; probability and non probability based sampling. Probability-based sampling is done by choosing a specific population of interest for the survey. Then, the probability of reaching the target population at a specific geographic location is researched. This way, the exact demographics that are desired to study will be reached. The nonprobability based sampling method samples a random portion of the population; which can lead to less specific gathered data. (Fink, 2006)

The group used nonprobability sampling methods. This method was chosen since nonprobability sampling methods are often the best choice when there are strict time constraints in place, and data must be gathered quickly. Since teacher demographics in England relatively homogenous, the choice to use a less specific method had little effect on the survey results. To ensure the group gathers data from an accurate representation of the UK science teacher population, the data will be compared to UK science teacher demographics.

A web-based survey was chosen over other forms of surveying, due to cost and rapid-deployment needs. Web based survey methods are often a free or low-cost distribution method. On the other hand, sending a survey via mail can cost around $10.97 per response. Initially, mailing surveys is relatively inexpensive, but since most are not returned, the cost is

ultimately higher per response. Mail has the largest response rate at 30 percent compared to email's 20 percent. Also, the mean respondent age for mail is 30 years old and the mean respondent age of web based surveys is 24. (Kaplowitz, 2004) Since most science teachers in England are between the ages of 25-59, the group expects a lower response rate. Yet, since a web based survey is lower in cost, compared to mail, email was the preferred survey method. To compensate for this and attain an accurate sample, the group distributed the survey to a substantial segment of the teacher population in England.

The group generated a list of secondary school heads by using the information provided by the Education Authority Directory. Since there are more schools listed in the Education Authority Directory than could be sent a survey, systematic sampling was used. Systematic sampling uses a list where every n^{th} person is contacted. The number n varies depending on number of people needed. For example, if a list has 1,000 names and the surveyor wants a sample of 10, then every 10^{th} name on the list will be selected. This method ensured that the group had a well rounded list of schools from a range of boroughs. Since schools are sorted by borough in the Education Authority Directory, the group used two pages of contact information then skipped six. Using two pages allowed two group members to enter data into the database at a time. The group skipped art, sport, and business specialized secondary schools since they focus less on science and are not a high priority for the Tower of London's outreach program. The list generated was well rounded since this method ensured an equal sampling of large and small boroughs. This method also allowed 1000 schools, minus bounced emails, to be reached. Internet based surveys have an average response rate of 20 percent, yet the group expected less than 100 of the surveys to be completed. This is because the group was emailing the school rather than the teachers themselves. The email must be forwarded by the schools secretary to the correct teacher. Also, UK science teachers are mainly made up of teachers 40-54, this age range is one of the least likely to use the internet. Finally, many teachers may not have time in there schedules to take the survey. The group hoped to minimise this by limiting the time it took to complete the survey to five minutes.

To manage the database of schools, Microsoft Excel 2007 was used. With Microsoft Excel 2007, it was possible to send personalized emails to a large group of people quickly and

efficiently. The group created an email that included specific fields for the programme to import names and schools from the database into. The email also included a link to the specific survey for the demographic the group chose to email. Access was then utilised to quickly email out the 1000 personalized emails per database through a built-in mail-merge application. Conducting the survey on a website, rather than in the email itself, allowed for the data to be easily, effectively, and reliably compiled. Also, using a website based survey allowed the group to create a more interactive experience. The group used Surveymonkey to host the survey. Surveymonkey was chosen due to its ease of use, reliability, cost, and previous experience with it.

In order to increase the number of responses, the group also contacted specific schools to gather personal science teacher email addresses. The group did this by picking a few boroughs around London and calling all of the schools in that area. The boroughs were picked based upon whether the group would be able to interview schools in that borough at a later date. The group hoped that specific interviews would be more effective than mass emails at reaching schools and gathering meaningful data. Unfortunetly, the group did not have time to interview any of these schools.

In conjunction with the systematic sampling, the group also used convenience samples. Convenience samples are done by surveying people that are willing to complete the surveys and are available when they are needed. (Fink, 2006) Using the list of science department emails previously generated, the group contacted teachers to set up meetings. The group hoped to meet with between 5 and 20 teachers to conduct convenience samples.

The surveys were constructed using closed questions and open-ended questions. By using a closed question format, the group was able to gather quantitative data for the comparison and analysis. (Fink, 2006)The open ended questions allowed the group to access personal opinions to consider when recommending changes to the loan box programme. By combining systematic and convenience samplings as well as using open-ended and closed questions the group was able to collect data that was broad enough to encompass a wide array of topics.

Before sending the survey out to teachers, the group pre-tested the survey with UK science teachers that visited the Royal Armouries. The science teachers were asked to review the questions and provide their comments and feedback regarding the survey. This ensured that the group collected accurate and meaningful results.

3.3.2 Data Analysis of Teacher Survey

To evaluate the potential success of the programme following the groups' thoughts for integration into the curriculum, the feedback from teachers was compiled. The answers for open ended questions were separated into general comments. Qualitative data was analysed on a percentage basis. Data was analysed using percentages rather than the number of responses to allow primary and secondary school data be easily compared.

Graphical methods for data presentation were also created. Maps and graphs were the main form of graphical presentations. The graphical presentations of data allowed the group to understand the information better and find patterns. All the maps were created using MapInfo Professional. The maps of England, on which the data was placed, were included in the MapInfo program. The first map used, UK Postaldist, included postal district information for the UK, and was used for mapping general survey data, such as where surveys were sent and received from. The World Map does not include postal codes for the UK, and so postal codes were attached to geographic areas using data from freethepostcode which provides latitude and logitudal coordinates for postal towns. This map allowed for a more accurate representation of where each school was located.

While many surveyed teachers provided the postal codes for their schools, some did not. To find their postal codes, first the group tried to find the postal code using the name of the school. If there were multiple schools by the same name, or if no school name was provided, then the county/borough information was used to try and find a postal district. Since teachers had two places to enter this information (at the beginning and in the contact section of the survey) there was a greater chance of this information being provided. Usually this information was too vague to generate an accurate postal code, so the group utilied the IP address of the respondent to find their postal town. The IP address that Survey Monkey collected would be searched for on http://www.dnsstuff.com. This website is capable of determining who an IP

address is registered to and where it originates from: including country, city, and mailing address. While it was originally though that IP addresses were going to be the primary method for determining school postal codes, it was quickly noticed that many schools use webhosts, such as Internet for Learning, that specifically serve UK schools. When searching for the IP addresses of schools that use these services, only information about the webhost is displayed, and the address of the school cannot be pin pointed. Therefore, searching for the postal district from the IP address was used as a last resort. Utilizing these three methods allowed for the location of nearly all the respondents to be pinpointed and plotted on maps. Only one postal code for secondary schools could not be determined. All of the other postal codes are believed to be an accurate representation of where each school is.

Two types of maps were created for both primary and secondary schools. The first map showed how the school would like to use the programme in conjunction with or in lieu of a visit to the Tower of London, whether the teacher had used an outreach programme before and whether the school would be interested in the programme. These three options allowed the group to see if distance plays a role in if schools would like to use the programme and how they would like to use the program. Also, whether the teacher had used an outreach programme before allowed the group to see if previous experience with an outreach programme influenced a teacher's interest in the Royal Armouries new outreach program. The second map which was created to determine whether distance from the Tower of London influences if teachers would be able to cover the cost of transportation for the loan box. This map also helped the group to determine if being able to cover the cost of transportation affected a teacher's interest in the programme.

Additionally, there is another map which was only created for secondary schools. The map show how many emails were sent to each postal district and how many surveys were completed per postal district. This map was created to see if a schools distance from the Tower affected how many responses were sent back. Also, this map ensured that the systematic sampling method used by the group created a database that encompasses all geographic areas of England. While it would have been helpful to create this map for primary schools, there was not enough time available to compile the data needed to create it.

3.4 Creation of Options for Polymer Box

Through evaluation of the different possibilities for how the loan box programme could be used, the group hoped to create a range of options for schools. The only existing option in the polymer box was a suggested order for the experiments and lecture that would take two days or more for each key stage. The group compiled both survey and interview data to also determine which options would work best for the Royal Armouries. The Higgins Armory museum, for instance, has done this by marketing the programme as both a precursor to a museum visit by a school and as an alternative to visiting the museum. (Higgins Armory Museum, 2008) The Boston Museum of Science only markets its outreach programme as an alternative to visiting the museum. (Boston Museum of Science, 2008) The University College London Museum's outreach programme is marketed as a teaching tool rather than as part of the museum. (UCL, 2008) Finally, The London Science Museum's outreach programme was created as an alternative to visiting the museum. (London Science Museum, 2008) By comparing the success of these programmes, the group gauged the most effective set of options to present to teachers in order to encourage further interest and utilisation.

3.5 Loan Box Promotion Options

The group also evaluated how to contact teachers and determine which method would be most effective for promoting the loan box. The group specifically sought to accomplish this by surveying teachers, interviewing other museums that have outreach programmes, and interviewing teachers. Surveying was accomplished on the internet via a survey hosting company called SurveyMonkey. Teachers were asked a series of questions, all revolving around marketing, which allowed the group to determine which methods would provide the most effective means of contacting teachers, and which methods would be the most cost effective for the Royal Armouries.

Questions asked included a variety targeted at determining which teachers by age preferred which methods of contact; how teachers would utilise the programme: either in conjunction with a visit to the museum, in lieu of a visit to the museum, or before and after a visit to the museum; which teachers were most reachable; and what counties did the survey

reach and garner responses from. Through questions that target these specific areas, the group gathered responses that allowed for the development of specific recommendations on how to: market the loan box programme, provide effective materials for teachers in the programme to encourage further use, and determine how to make it the most cost effective for schools, to ensure the mission to teach and educate is ultimately carried forth.

3.6 Website Design

The final objective of the project is to develop recommendations and suggested content to include in the education section of the current Royal Armouries website. Through the development of a set of recommendations for the Royal Armouries website the group hopes that they will be able to not only fulfil this objective, but to aid in developing a solution which inspires teachers to utilise the programme and engage children's' interest in the sciences through the loan box programme.

In order to accomplish this, the group utilised the data gathered from the primary and secondary teacher surveys to select the content for the website and develop recommendations for integration of this content into the current site.

3.6.1 Website Content Options

Due to the current design of the Royal Armouries website, the group was unable to physically develop any portion of it. As a result, the group elected to instead develop a recommended extension to the navigation scheme and pages of the website, and recommend content that should be included on those pages. The group believes these recommendations will provide a basis for the development of a comprehensive set of pages on the website that convey the breadth of the loan box programme and the potential it has to engage and inspire students in the sciences.

The first step in designing the recommendations was developing the extension to the navigation scheme. The group broke down the current Science Outreach page into its three components: The Loan Box Programme, Object Based Material Science Session, and Perfecting Progression – Amazing Armour. After review of the content of each subsection, the group then made recommendations on how the content should be effectively split and reorganized to

make way for a section specifically dedicated to the Loan Box Programme. After carving a niche for the Loan Box to fit into the website, already written content was identified and modified to fit the new recommended navigational design. Then, following that, additional content was written with the input of the survey data and teacher interviews to promote and publicize the loan box programme. This content was fit into the navigational scheme, again with the help o f the marketing info derived from the surveys.

3.6.2 Website Creation

As mentioned previously, the group was not provided the opportunity to develop the website due to constraints regarding modification. Since this was the case, the group submitted the recommendations and content to the Royal Armouries in report format. The group hopes that the recommendations will aid the Armouries in their endeavour to promote this valuable programme to teachers. Additionally, the group hopes the basic website extensions that were recommended will be expanded to incorporate interactive tools for students.

Following submission of the recommendations, the content will be reviewed by a Royal Armouries education officer, submitted to Stuart Harrington (webmaster), and ultimately incorporated into the website.

4 Results and Discussion

The following section includes the results and discussion of the data generated from the methods outlined in the methodology section. Data was collected utilising interviews of both museums and teachers, surveys of primary and secondary teachers, and evaluation of the current Polymers box. All of the data is delineated and broken down below.

4.1 Museum Interviews

All museum interviews were conducted following the basic museum interview questions guideline sheet the group created. In some cases more questions were asked, and in some cases less, depending upon whether it was relevant during the interview. (Appendix B: Museum Interviews - Outreach Programme Interview Questionnaire)

4.1.1 Higgins Armory

The Higgins Armory outreach programme manager currently does not have a director so no programme usage statistics were available. The Higgins Armoury tries to inform teachers about the programme through mailing lists and personal distribution of fliers to teachers at schools. Pre and post visit support for schools also helps draw teachers to the programme. The curator of the Higgins Armory stressed that multimedia is important. The more interactive programmes are, the easier it is from a teacher's perspective to get children engaged and keep them engaged. A wide range of media types helps to increase teacher knowledge and usage of the programme. (Appendix B: Museum Interviews - Outreach Programme Interview – Higgins Armory)

4.1.2 The Boston Museum of Science

The Boston Museum of Science reaches about 283 school districts in the New England area annually. One of the most effective tools the Boston Museum of Science uses to reach teachers is mailings. Additionally, they encourage teachers sign up for a programme called The Teacher Partner Programme. Through this, K-12 teachers have the opportunity to receive exclusive benefits. These include free individual Exhibit Hall admission, free individual pre-field trip admission to all the theatres, discounts on Museum memberships and courses, 10% discount at

the museum store, the ability to borrow from the Educator Resource Center and Lyman Library, and tickets to all venues at school group rates for up to 12 visitors. Registration for the programme is easily done in person or online. This is an easy way for the Museum of Science to keep in touch with teachers: currently over 12,000 teachers are subscribed to this programme and receive their e-newsletter and other benefits through it.

Initially the outreach programme at the Boston Science Museum consisted of actors sent out to create another source of revenue for the Museum. Since it started, the programme has become strictly educational and consists of interactive presentations, rather than actors demonstrating quasi-science. Additionally, the Museum has found that schools recognize outreach programmes are not the same as visiting the museum, and thus there is no loss in revenue. There are factors that weigh heavily in the decision to take a field trip to a museum, such as cost, both of admittance and transportation. Many schools in Massachusetts and the New England area cannot afford the cost of bussing a large group of students into Boston and the outreach programme provides a cost-effective alternative.

To begin their relationship with teachers, the director found that the most effective form of communication was direct and personal contact. A lot of time was spent making personal contact with teachers, whether in the form of a phone call, a face-to-face meeting, or both. This created a solid base of teachers interested in using the programme and who have personal ties to the museum. The director works avidly to maintain these personal connections to keep teachers invested in the museum. One of the easiest ways they found to communicate new events and programmes are through mailers; from small postcards to full-size glossy booklets. The downside to these is their cost, but the return on them has been good thus far. The museum also makes sure to communicate with teachers about changing curriculum needs, which allows them to create programmes that easily fit into the curriculum and supplement what the children are learning on a daily basis. All of these factors contribute to the strong relationship that the Boston Museum of Science has been able to create with the educational community in New England.

4.1.3 The University College London

The Museums at the University College London's (UCL) outreach programme is based primarily around history. Loan boxes from UCL's museums only began to be utilised after the director held personal meetings or contacted teachers. In order to do this, she cold-called a substantial number of schools and attended different educational events. Some of the educational events she went to were teacher training days, conferences for teachers, and committee meetings for some of the schools. Once she received a reliable contact from a school, she relied on that person to guide her to individuals that could utilise their loan box programme. One of the things she did quite often, initially, was sending faxes, which can be an easy way to contact teachers because secretary's simply have to put the faxes in their pigeon hole.

Annually about fifty schools use one of the programmes offered by UCL, some schools host more than one programme from them in an academic year. To help sell teachers on the idea they offer an education officer to go with the box, and offer the programme free of charge. To use the box, teachers must agree that a teacher will be present during the demonstration for discipline issues, and that the box will be picked up from its location at UCL. They currently only work with public schools because they feel public schools need the programmes more. Also, the boxes are integrated into the curriculum and come with supplemental material for children to use after the programme has been given. UCL has built a successful programme for the use of their loan boxes by finding innovative ways to contact teachers and offer alternatives when financial issues are a concern.

4.1.4 The London Science Museum

The London Museum of Science began an outreach programme about eight years ago. This programme began to address the fact that a visit to the museum can be timely and expensive for some schools. Also, after the Tube bombings many schools did not want to risk bringing large groups of students on public transportation. They do not currently offer a loan box programme, but are working to put together boxes for schools to purchase and use in the classroom.

The outreach programme they currently offer is more of a performance that they bring to schools; five people are employed for this programme full time. The Museum of Science gets roughly 100-150 schools to participate in their programme annually. In some cases they have been able to provide their outreach performance free of charge because of support from companies such as Shell and British Petroleum (BP).

Additionally, they send out mailings to 11,000 schools, which include schools from both inside and outside of London. In their experience it has been easier to get schools outside of London to participate in the programme because of the lack of resources generally available to them. The most important thing in a programme is to make it as easy to use as possible for teachers. When creating the loan box, there needs to be anything and everything already contained in the supplies sent to them. Also, it needs to be well explained and laid out in an easy to follow and use manner. Many primary school teachers do not specialize in science and will be uncomfortable teaching a new programme where they may not know the material or content of the programme very well.

4.2 Teacher Surveys

Teacher surveys were conducted online via a survey hosting company known as SurveyMonkey. While the same survey was used for each sampled group (Appendix C: Internet-Based Survey), the data was gathered independently for secondary schools, primary schools, and cold-called schools, to allow for better analysis. Below the results from the survey data have been discussed as raw data and segmented data

4.2.1 Secondary School Survey Results

The secondary school survey conducted via SurveyMonkey was sent to 1000 schools via email and an additional 5 teachers who were contacted by a previous group, and gathered 80 responses from 19 of May to the 6 of June, 2008, resulting in an 8.0% response rate. The 80 responses represent 45 postal districts in Great Britain. The results discussed below are the combined and averaged answers of all respondents. The survey questions can be reviewed thoroughly in Appendix F: Secondary School Raw Survey Results.

4.2.1.1 Demographic Questions

The first five questions of the survey aimed to gather basic demographic information. This allowed the results to be compared by age, sex, and geographic location of each teacher. This information also ensured that the group was getting an accurate representation of UK science teachers.

The first question on the survey was: "What's your gender?" All 80 respondents answered this question, with 60.8% responding female and 29.2% responding male. This is not surprising, since approximately 59% of all teachers in the U.K are female. (Life Long Learning, 2007) This is the group's first indication that they have collected data that is an accurate representation of UK Science teachers.

The next question was: "What county [borough] do you teach in?" This question gathered 74 responses, with 6 teachers electing to skip it. After reviewing the responses to this question individually, the group found that a fairly equal representation of Britain was gathered with schools with teachers from Southern to Northern England having answered the survey.

Another demographic question was: "What is your age?" The results of this question as segmented by time of response (first versus second emailing of the survey), will be discussed in section 4.2 Teacher Surveys. At the end of the surveying time period 38% of all respondents fell into the 20-35 age-range. This is somewhat surprising since only 19% of science teachers are between the ages of 25-34. (Life Long Learning, 2007) Of the remaining respondents, 38% fell into the 35-50 age-range, 22.8% fell into the 50.65 age-range, and 1.3% fell into the 65+ age range. This loosely follows UK Science teacher demographics since 44% of teachers are between the ages 35-49 and 37% of teachers are above 50 years old. Refer to Figure 6 – Secondary Teachers' Responses by Age

	Response Percent	Response Count
20-35	38.0%	30
35-50	38.0%	30
50-65	22.8%	18
65+	1.3%	1

Figure 6 – Secondary Teachers' Responses by Age

The fourth demographics question was: "On average how many students are in your classes?" This question both allowed the group to determine how large the average class was, and the quantities of materials that need to be provided in the loan box for an average class session. All 80 teachers responded to this question. The results were averaged to find that approximately 27 students are in a key stage 3 or 4 classes.

Another question was: "What key stage do you primarily teach?" Since the schools the group sent the surveys to were all secondary schools, the group had a reasonable expectation that the majority of teachers responding to this question would be teaching either key stage three or four. And, indeed, this proved to be the case, with the responses split between most teachers teaching either key stage three, key stage four, or both.

The last demographic question asked on the survey was: "Have you visited the Tower previously with your students?" Of the total 80 respondents, 79 answered the question, with 97% responding that they had never visited the tower with their students, and only 2.5% responding that they had. The results for this question were not particularly surprising, especially considering that the responses were gathered from schools covering the entirety of England. In addition, the teachers surveyed were science teachers, who traditionally would not be looking to visit a history-based sight with their students.

4.2.1.2 Marketing Questions

This section of the survey gave the group a greater understanding of the best ways to market the loan box programme to teachers. Questions such as what is a teachers favoured

method of receiving information, and when they would like to hear about the survey allowed the group to determine how to best target teachers and get them information about the loan box programme. This information allowed the group to create a set of recommendations for the Royal Armouries about their polymers box.

The first question in this section (question seven on the survey) asked teachers to rank which forms of communication they would be most likely to respond to. All 80 respondents answered this question. The forms of communication that teachers answered they were most likely to least likely to respond to, are as follows: email, websites, personal phone calls, newsletters, and mailings. (Figure 7 – Secondary teachers preferred contact method) While this question allowed the group to quickly assess which forms of communication may be the best to reach the greatest number of teachers, the group acknowledges that this question is biased, since all the teachers who took the survey were reached via email or electronic communication methods. Still, the internet-based survey's gathered the greatest number of responses, while the question is biased towards email, which was discovered when the group analyzed the results from teachers that were cold-called; it may be the most effective means to communicate.

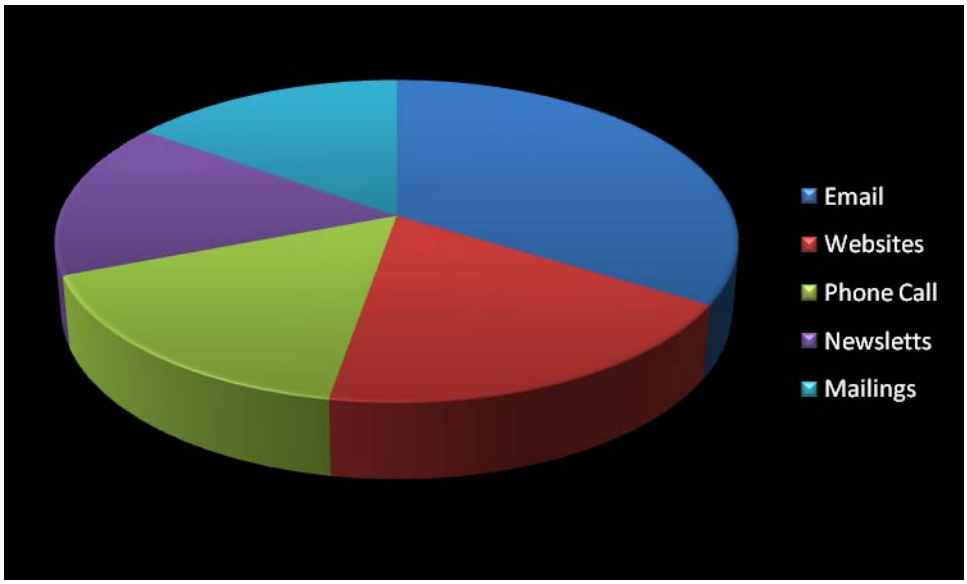


Figure 7 – Secondary teachers preferred contact method

The next question (question 8), was: "Have you utilised any outreach programme or outreach materials in your curriculum before?" Only 77 elected to answer this question and

surprisingly, 31.2% of respondents said they had used an outreach programme. This was substantially higher than expected, and indicates that teachers are indeed willing to use loan box and other outreach programmes. 68.8% of respondents said that they had not utilised an outreach programme or loan box in their curriculum before.

"When would you need to know about the loan box programme to successfully plan a programme in your classroom?" was the third question asked (question 9). All respondents answered this question, with the majority (30.0%) answering that they needed to know at least 8 weeks in advance to use the program. Additionally, it is significant to mention that many teachers (22.5%) elected to respond 'other', and stated that they would need to know several months in advance to adequately incorporate the programme, and that it may be best to know about the programme the summer before the beginning of the next school year to use it in the next year. (Figure 8 – Secondary teachers time before implementation)

	Response Percent	Response Count
2 weeks before	7.5%	6
4 weeks before	12.5%	10
6 weeks before	27.5%	22
8 weeks before	**30.0%**	24
Other (please specify)	22.5%	18

Figure 8 – Secondary teachers time before implementation

Question ten on the survey was: "Would school incentives increase your interest in the programme?" This question was primarily targeted at determining the affordability of the programme and the need to provide incentives to teachers to encourage there interest and excite them about the programme. Of all the respondents, three skipped the question, with 77 responding to it. Of those 77 respondents, 84.4% responded that yes, incentives would increase their interest, and 15.6% responded no. While the results of this question are important, and indicate a possible strategy for increasing interest in the programme, it must be acknowledged

that whenever the notion of 'free' is brought forth, the usual response by any individual is to take it.

The next question in this section (question 11) was: "Would your school be able to cover transportation costs for the loan box?" This question was directly aimed at determining whether it would be feasible to charge schools a fee to use the box, and if asking schools to cover the cost of transportation for the box was going to be a deterrent to them using it. Of all respondents, 75 elected to answer this question. 54.7% responded that no, , and 45.3% responded that yes. This question raises the concern that the box may not be utilised by teachers, since it may be more cost effective for schools to simply go out and buy the materials to do the experiments, rather than pay to transport the box. (Figure 9 – Secondary schools ability to cover transportation costs)

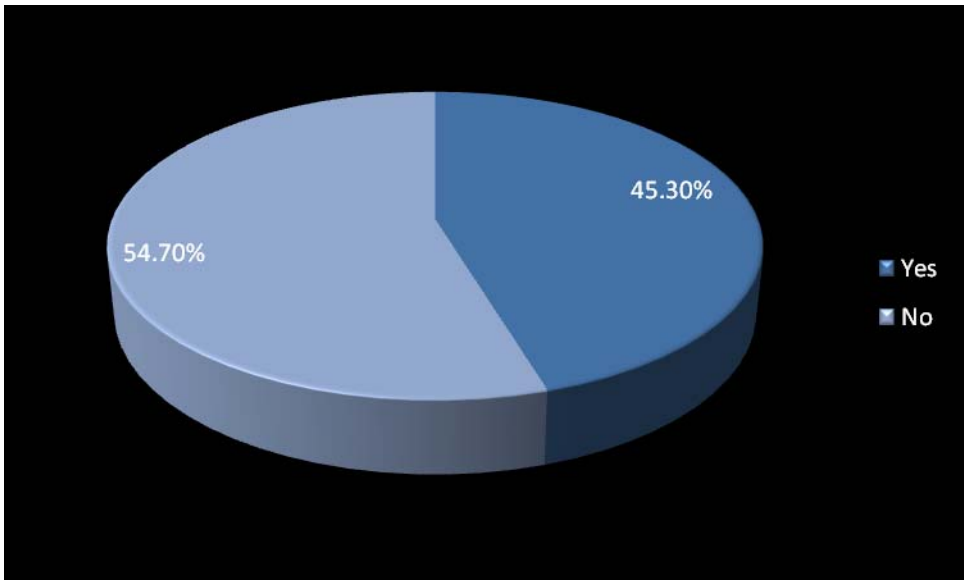


Figure 9 – Secondary schools ability to cover transportation costs

"Would you use the loan box programme (Key Stage 2, Key Stage 3)?," was the 12th question on the survey. Of all respondents 78 elected to answer the question. 92.3% responded that yes, they would utilise the programme, while 7.7% responded that no they would not utilise the programme. These results specifically answer the question of whether or not it is feasible to have a loan box programme and the answer is that yes, it is. Unfortunately, it is impossible to know why 7.8% responded no to this question since there was no request for teachers to state why they wouldn't use it. Possible reasons range from lack of adequate

knowledge about the programme to make a decision on whether or not they may use it, to unwillingness to try something new in the classroom.

The next question sought to determine how the loan box programme should best be implemented with the current outreach programmes and solicited school visits. Question 13 asked: “How would you use the loan box programme?” All but 3 of the total number of respondents answered this question. 53.2% stated that they would use it in lieu of a visit to the museum, 28.6% responded they would use it before and after a visit to the museum, 11.7% said they would use it before a visit to the museum, and 6.5% said they would use it after a visit to the museum. These results are congruent with the notion that in order to learn a concept it must be presented, then reinforced, and then presented again (Figure 10 - How secondary teachers would use the loan box).

	Response Percent	Response Count
In lieu of a visit to the museum	**53.2%**	41
Before a visit to the museum	11.7%	9
After a visit to the museum	6.5%	5
Before and after a visit to the museum	28.6%	22

Figure 10 - How secondary teachers would use the loan box

The final marketing question asked: “Would you prefer someone to accompany the loan box to aid in teaching it for a day?” Of all respondents, 78 answered this question. 75.6% of the respondents said that they would prefer someone (educational officer) to accompany the loan box to teach it, while 24.4% said that they would not prefer someone to accompany the loan box to aid in teaching it.

4.2.1.3 Open Response Questions

The final section of the survey primarily sought to ask questions of teachers that would give the group further insight into additional possibilities for the loan box, other needs that may need to be met, or how and what level of information needs to be relayed to teachers.

Furthermore, this section provided an opportunity for teachers to provide insight into other experiences with outreach programmes, desires for more information about the programme, or simply statements of confusion.

The first open response question (question 15) asked teachers "What supplements would you like to see with an outreach programme (such as a website, teaching manual, homework, PowerPoint presentation, etc.)?" Of the total number of respondents to the survey, 67 answered this question. Many teachers (Refer to Appendix F: Secondary School Raw Survey Results) stated that they would appreciate having a website, teaching manual, homework and PowerPoint presentation. While this question certainly opened the door for teachers to simply state they would like all of the material the group mentioned, many teachers went above-and-beyond, and stated that they would also like to see some material which provided information on how the programme fit into the curriculum. Additionally, many teachers also stated that they would like to have lesson plans and sample lessons plans to use with the loan box.

The next question in this section (question 16) asked teachers "How would you like to see the Royal Armouries become more involved with you and your school?" 39 teachers chose to answer this question. There was a wide array of answers, with three predominant themes. Many teachers wanted the Armouries to provide resources which emphasized materials in our world. Teachers also wanted to see resources which integrate the history of armour and the science of its development. Lastly, many respondents stated they would like the Royal Armouries to provide cost-effective means for schools that are too far/can't afford to visit the Armouries with resources which would still allow them to teach material science in an interesting and informative manner. (Refer to Appendix F: Secondary School Raw Survey Results for all responses)

The last open response question on the survey, question 17, asked teachers to provide any additional comments. Of all respondents, nine chose to respond to this question. The majority of teachers expressed an interest in talking with the Royal Armouries about the programme and desired more information so they could determine how they could fit it into their curriculum. (Refer to Appendix F: Secondary School Raw Survey Results for all responses)

The final question (question 18) asked on the survey was: “If you would like to be contacted regarding the outreach programme, please provide contact details below:” Sixty-one teachers provided their contact information, providing a valuable resource. The question was asked with the intent of gathering a list of teachers who at the least would like more information about the programme, and at best may use the programme. The results on this question are very encouraging, and indicate a strong interest in the programme from teachers. (Refer to Appendix F: Secondary School Raw Survey Results for all responses)

Finally, information was collected in the background on where teachers were filling out the survey (IP Address) from how much time they took to fill out the survey, what time of day they took the survey, and what date they took the survey on. This data will further be discussed in the *The data for* this survey was gathered from teachers who provided email addresses after they were cold-called by the group. Of the 20 email-addresses that were compiled over the course of two days, 13 were determined to be legitimate addresses after seven bounced back. As a result of sending the survey to 13 addresses, provided by teachers who said they would be willing to complete the survey, only two actually completed the survey. While this is a response rate of 15.8%, the sample size is not great enough to warrant substantial discussion, and the majority of data when looked at independently is statistically insignificant. (Appendix H: Personal Email Raw Survey Results)

There were, however some questions that have significant implications. The first of which, is question 3 which asks for the respondents age. Both respondents said they fit into the 35-50 year category. This is perhaps an indication that the older generation of teachers, still prefers to be contacted on a personal basis via phone. (Figure 17 - Age of cold-called teachers)

	Response Percent	Response Count
20-35	0.0%	0
35-50	**100.0%**	2
50-65	0.0%	0
65+	0.0%	0

Figure 17 - Age of cold-called teachers

The second question that is significant is question seven, which specifically asked teachers which method of communication they were most likely to respond to. The results broke down as follows: mailings, newsletters, direct phone calls, emails, and then websites. This perhaps indicates that again, the older generation of teachers prefer more standard forms of communication, where they are personally contacted or informed on a regular basis about upcoming events, ideas or programmes. (Figure 18 - Preferred contact method for cold-called teachers)

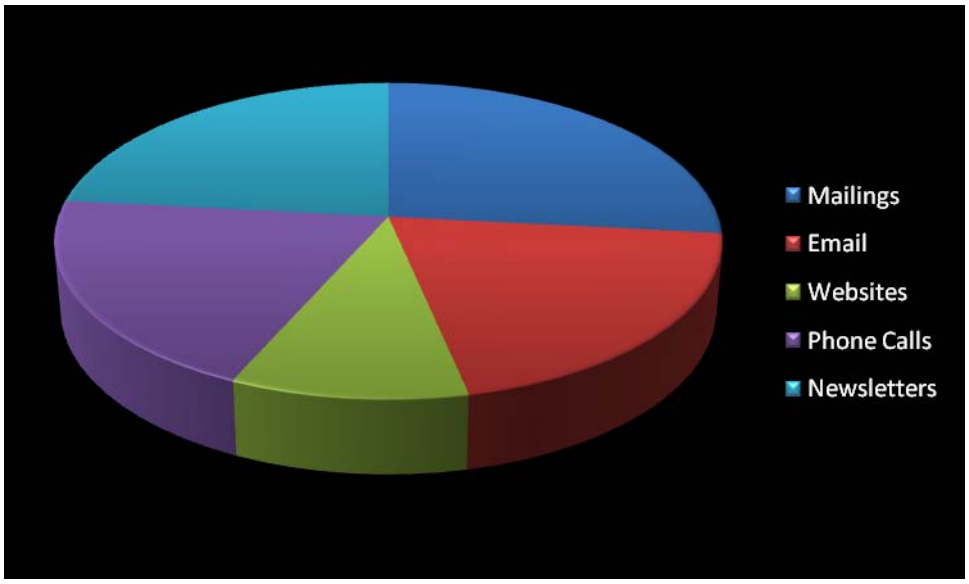


Figure 18 - Preferred contact method for cold-called teachers

Both of the questions highlighted above, indicate that while the 35-50 age-range of teachers prefers direct-personal-contact, it may be impractical if the desired means of contact is via electronic communication. Additionally, the labour required to gather two responses from direct-personal-contact far outweighs that required to gather 98 good responses from other methods.

Segmented Survey Data section below.

4.2.2 Primary School Survey Results

The primary school survey conducted via SurveyMonkey was sent to 1000 schools via email, and gathered 18 responses from 22 of May to the 13 of June, 2008, resulting in a 1.8% response rate. The 18 responses represent 13 postal districts in Great Britain. While the group

acknowledges that this sample size is small in comparison to the number of surveys that were sent out, the group believes valuable insight can be drawn from the data. Furthermore, this data demonstrates the differences between how to reach and encourage use of the programme in primary versus secondary schools. The results discussed below are the combined and averaged answers of all respondents. The survey questions can be reviewed thoroughly in **Error! Reference source not found.**

4.2.2.1 Demographic Questions

The survey sent to primary school teachers was the same survey that was sent to secondary teachers, although the results were collected separately for analysis. The first five questions of the survey aimed to gather basic demographic information. This allowed the results to later be segmented and inferences to be made as to how to best contact and reach teachers.

Question one on the survey asked: "What's your gender?" All 18 respondents answered this question, with 72.2% responding female and 27.8% responding male. This is similar in comparison to the teachers who responded to the secondary school survey; again demonstrating that perhaps female teachers are more likely to respond. This could alternatively mean there is a higher percentage female science teachers in primary schools, rather than secondary schools. (Figure 11 - Primary school respondents' gender)

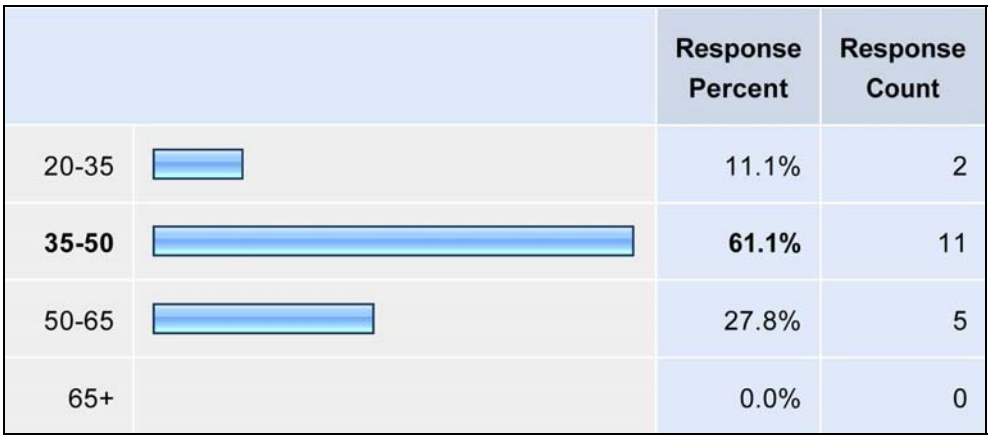
	Response Percent	Response Count
Male	27.8%	5
Female	**72.2%**	13

Figure 11 - Primary school respondents' gender

The next question was: "What county [borough] do you teach in?" This question gathered 18 responses too. Since the survey sample was so small, the group was unable to fully develop conclusions regarding demographic information from this question.

Another question was: "What is your age?" The results of this question at the end of the surveying time period broke down as follows: 11.1% of all respondents fell into the 20-35 age-

range.. Of the remaining respondents, 61.1% fell into the 35-50 age-range, and 27.8% fell into the 50.65 age-range, while no one fell into the 65+ category. This follows the demographics of UK science teachers. Additionally, this question is particularly interesting since it contradicts the data gathered from secondary school teachers. It seems that the middle-aged teachers were most likely to respond, perhaps because they had the most time available. (Figure 12 - Primary school respondents' age)



	Response Percent	Response Count
20-35	11.1%	2
35-50	**61.1%**	11
50-65	27.8%	5
65+	0.0%	0

Figure 12 - Primary school respondents' age

"On average how many students are in your classes?," was another demographics-related question that was asked. This question both allowed the group to determine how large the average class was, and the quantities of materials that need to be provided in the loan box for an average primary school class session. All 18 respondents again responded to this question, and the results were averaged to find that approximately 30 students are in key stage one or two classes.

The group also asked "What key stage do you primarily teach?" to ensure that the survey was composed of information from the key stage the group was targeting. Since the schools emailed and asked to fill-out the survey were all primary schools, the group had a reasonable expectation that the majority of teachers responding to this question would teach the first two key stages. This proved to be the true, with the responses split between most teachers teaching key stage one, key stage two, or both.

The last demographic question asked on the survey was: "Have you visited the Tower previously with your students?" All respondents answered the question, with 77.8% responding that they had never visited the Tower with their students, and 22.2% responding that they had.

The results of this question were interesting, as they refute the data gathered from surveying secondary school teachers.

4.2.2.2 Marketing Questions

As with the secondary school survey, the second section of the primary school survey also focused on marketing-centric questions. Comparing the results of both surveys, and specifically the overarching sections, later allowed the group to segment the data and deliver more accurate results. These results were then utilised to make recommendations how on to target desired demographics of teachers.

The first question in this section (question 7 on the survey) asked teachers to rank which forms of communication they would be most likely to respond to. The forms of communication that teachers answered they were most likely to least likely to respond to, are as follows: email, websites, mailings, newsletters, and lastly direct personal phone calls. (Figure 13 - Primary teachers preferred contact method)

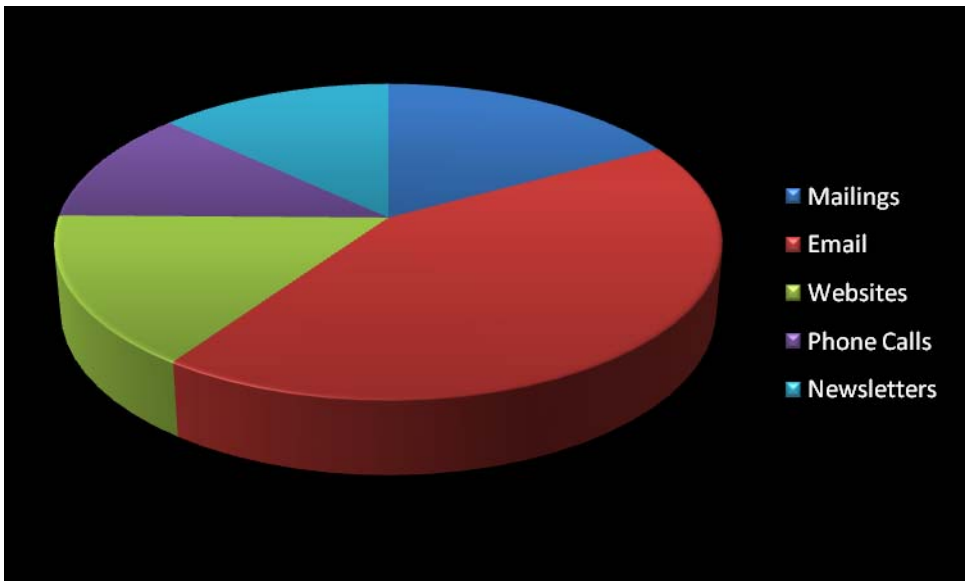


Figure 13 - Primary teachers preferred contact method

The group asked teachers “Have you utilised any outreach programme or outreach materials in your curriculum before?” also. 88.2% of respondents said that they had not utilised an outreach programme or loan box in their curriculum before, while 11.8% said they had. While the number of teachers who have used an outreach programme is significantly lower for

primary schools, it is still encouraging. Additionally, this provides a large segment of teachers which may be interested in utilising the programme.

The next question (question 9) was: “When would you need to know about the loan box programme to successfully plan a programme in your classroom?” The majority (44.4%) answered that they needed to know at least 8 weeks in advance to use the programme. Additionally, many teachers (22.2%) elected to respond ‘other’, and stated that they would need to know several months to a year in advance to adequately incorporate the programme. (Figure 14 - Primary teacher time before implementation)

	Response Percent	Response Count
2 weeks before	0.0%	0
4 weeks before	0.0%	0
6 weeks before	33.3%	6
8 weeks before	**44.4%**	8
Other (please specify)	22.2%	4

Figure 14 - Primary teacher time before implementation

“Would school incentives increase your interest in the programme?,” was another question the group asked teachers. This question was primarily targeted at determining the affordability of the programme and need to provide incentives. 61.1% responded that “yes” incentives would increase their interest, and 38.9% responded no, it would not increase their interest in the programme.

Question eleven on the survey was: “Would your school be able to cover transportation costs for the loan box?” Primary school teachers responded with a more definite “no”, than secondary teachers, with 77.8% responding that their school would not be able to cover the cost, and 22.2% responding that, their school would be able to cover the cost of transportation. (Figure 15 - Primary school’s ability to cover transportation costs)

		Response Percent	Response Count
Yes		22.2%	4
No		**77.8%**	14

Figure 15 - Primary school's ability to cover transportation costs

"Would you use the loan box programme (Key Stage 2, Key Stage 3)?" was the twelfth question the group asked on the survey. The majority of teachers, 83.3%, responded that yes, they would utilise the programme, while 16.7% responded that no they would not utilise the programme. Unfortunately, as was the case with the secondary school survey results, it is impossible to know why 16.7% responded no to this question, since there was no requirement for teachers to state why they wouldn't use it.

The next question sought to determine how the loan box programme should best be implemented with the current outreach programmes and solicited school visits. Question 13 asked: "How would you use the loan box programme?" About half of all respondents, 56.3%, stated that they would use it in lieu of a visit to the museum, 37.5% responded they would use it before and after a visit to the museum, 6.3% said they would use it before a visit to the museum, and 0% said they would use it after a visit to the museum. (Figure 16 - How primary school teachers would use the loan box) These results are congruent with the secondary school survey results.

		Response Percent	Response Count
In lieu of a visit to the museum		**56.3%**	9
Before a visit to the museum		6.3%	1
After a visit to the museum		0.0%	0
Before and after a visit to the museum		37.5%	6

Figure 16 - How primary school teachers would use the loan box

The final marketing question asked: "Would you prefer someone to accompany the loan box to aid in teaching it for a day?" About 61.1% of teachers said that they would prefer someone (educational officer) to accompany the loan box to teach it, while 38.9% said that they would not prefer someone to accompany it. It is surprising though, that fewer primary schools teachers, versus secondary school teachers, would like an educational officer to accompany the loan box.

4.2.2.3 Open Response Questions

The final section of the survey was the open response section, where teachers were given the opportunity to provide the Royal Armouries with feedback and suggestions regarding their loan box programme. The details below are simply a highlight of the many responses received. The entirety of comments and suggestions can be reviewed in **Error! Reference source not found.**

The first open response question asked: "What supplements would you like to see with an outreach programme (such as a website, teaching manual, homework, PowerPoint presentation, etc.)?" Sixteen teachers provided comments regarding this question. Similar to secondary school teachers, several primary school teachers (Refer to Appendix F: Secondary School Raw Survey Results) stated that they would appreciate having a website, teaching manual, homework and PowerPoint presentation. While this question certainly opened the door for teachers to simply state they would like all of the material we mentioned, many teachers went above-and-beyond, and stated that they would also like to see some material

which provided information on how the programme fit into the curriculum. Additionally, many teachers also stated that they would like to have lesson plans and sample lessons plans to use with the loan box. These results were very similar to those for the secondary school data gathered from surveying.

The next question in this section (question 16) asked teachers "How would you like to see the Royal Armouries become more involved with you and your school?" Eight teachers chose to provide feedback for this question. Similar to secondary school teachers, many primary school teachers wanted the Royal Armouries to provide resources which integrate the history of armour and the science of its development. Also, many respondents stated they would like the Royal Armouries to provide cost-effective means for schools to utilise the loan box programme These results are again, extremely similar to those that were gathered from the secondary school teachers survey. (Refer to Appendix F: Secondary School Raw Survey Results for all responses)

Another question on the survey (question 17) asked teachers to provide any additional comments. Four teachers responded to this question. The majority of teachers expressed an interest in talking with the Royal Armouries about the programme and desired more information so they could determine how they could fit it into their curriculum. (Appendix F: Secondary School Raw Survey Results)

The final question, question 18, asked on the survey was: "If you would like to be contacted regarding the outreach programme, please provide contact details below:" Fifteen teachers provided information to contact them with more information. This allowed the group to compile a list of teachers to provide to the Royal Armouries to contact and hopefully interest in utilising the programme. (Refer to Appendix F: Secondary School Raw Survey Results for all responses)

4.2.3 Personal Email Sampling Surveys

The data for this survey was gathered from teachers who provided email addresses after they were cold-called by the group. Of the 20 email-addresses that were compiled over the course of two days, 13 were determined to be legitimate addresses after seven bounced back.

As a result of sending the survey to 13 addresses, provided by teachers who said they would be willing to complete the survey, only two actually completed the survey. While this is a response rate of 15.8%, the sample size is not great enough to warrant substantial discussion, and the majority of data when looked at independently is statistically insignificant. (Appendix H: Personal Email Raw Survey Results)

There were, however some questions that have significant implications. The first of which, is question 3 which asks for the respondents age. Both respondents said they fit into the 35-50 year category. This is perhaps an indication that the older generation of teachers, still prefers to be contacted on a personal basis via phone. (Figure 17 - Age of cold-called teachers)

	Response Percent	Response Count
20-35	0.0%	0
35-50	**100.0%**	2
50-65	0.0%	0
65+	0.0%	0

Figure 17 - Age of cold-called teachers

The second question that is significant is question seven, which specifically asked teachers which method of communication they were most likely to respond to. The results broke down as follows: mailings, newsletters, direct phone calls, emails, and then websites. This perhaps indicates that again, the older generation of teachers prefer more standard forms of communication, where they are personally contacted or informed on a regular basis about upcoming events, ideas or programmes. (Figure 18 - Preferred contact method for cold-called teachers)

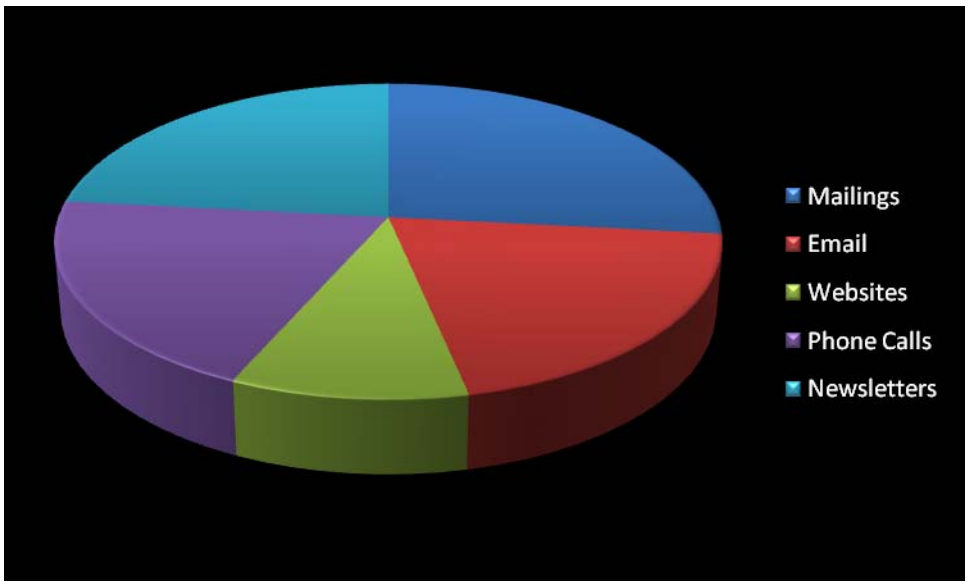


Figure 18 - Preferred contact method for cold-called teachers

Both of the questions highlighted above, indicate that while the 35-50 age-range of teachers prefers direct-personal-contact, it may be impractical if the desired means of contact is via electronic communication. Additionally, the labour required to gather two responses from direct-personal-contact far outweighs that required to gather 98 good responses from other methods.

4.2.4 Segmented Survey Data

By segmenting the data, the group gained a greater understanding of teachers' needs and desires, and how to implement the loan box programme to suite their needs. Graphically displaying the data allowed the group to see patterns and determine and see what factors influence a teacher's thoughts about the programme. With this information, recommendations and suggestions were created on how to modify the box to promote and optimise teacher usage of the programme. This section is split into primary and secondary schools with the assumption that these two groups are likely to respond to the programme differently.

4.2.4.1 Primary Schools

While the primary school response rate is lower than the secondary school's response rate, the group believes the data is still relevant and statistically significant. Figure 19 is a map of England that shows whether schools that responded would use the loan box programme,

have used a loan box programme before, and if they would use the programme in conjunction with or in lieu of a visit to the Tower of London. Together, this data shows what factors can influence a teacher's decision to use the loan box programme. Of all the schools that responded, only three said they would not want to use the programme. While the group does not have a definite data on why a school may not want to use the program, a schools distance from the Tower of London may have played a factor as to whether teachers would like to use the loan box programme. The closest school that would not use the programme was more than 106 km away in Cambridge. To determine if cost of transportation was an issue, Figure 20 was created.

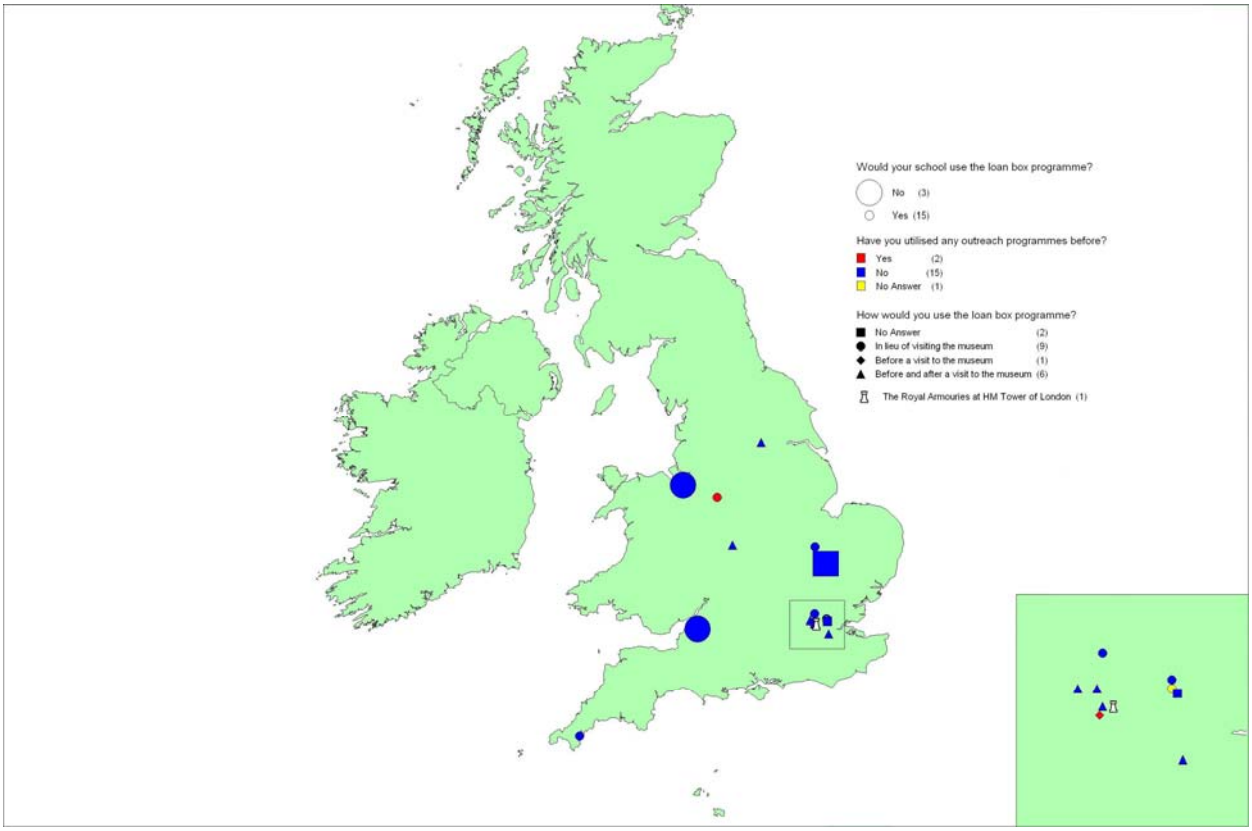


Figure 19 Primary School interest in the programme vs. utilisation of other outreach programs vs. how they would use the program

Figure 20 demonstrates that there is a very small correlation between whether schools can pay for the transportation of the loan box programme and whether they are interested in the programme. Schools near the Tower of London were more likely to be able to pay for the programme verse those who were farther way. Being unable to pay for the transportation of the loan box did increase the chances that a school may not be interested in the program. The

group has no data that would indicate whether this or isn't the cause of disinterest in the programme.

Figure 20 Primary School ability to pay for transportation vs. interest in the programme

If the Tower of London is going to continue contacting schools via electronic means, it is important to understand how long it may take teachers to respond. Figure 21 displays the time at which each age group responded to the survey. This data was far from the expected result since there were only two teachers between the ages 20-35 that responded at such startlingly different times. With 27% of UK internet use in the past three months by people aged 16-24 and 51% of people aged 16-44, teachers aged 20-35 should be the most connected group of teachers. (Pollard, 2007) Therefore, it is not surprising that the first teacher to respond to the survey was aged 20-35. Likewise, it is surprising that the last teacher to respond to the survey was between 20-35.

Another area where our responses differ from what was expected was that more teachers answered the survey after the group sent a reminder email on May 2nd. The group

expected that a large number of teachers would initially answer the survey and then numbers would slowly dwindle, until a reminder was sent which would create a second, smaller surge of respondents to the survey. Unfortunately, this did not happen because the group sent the original survey on a school holiday.

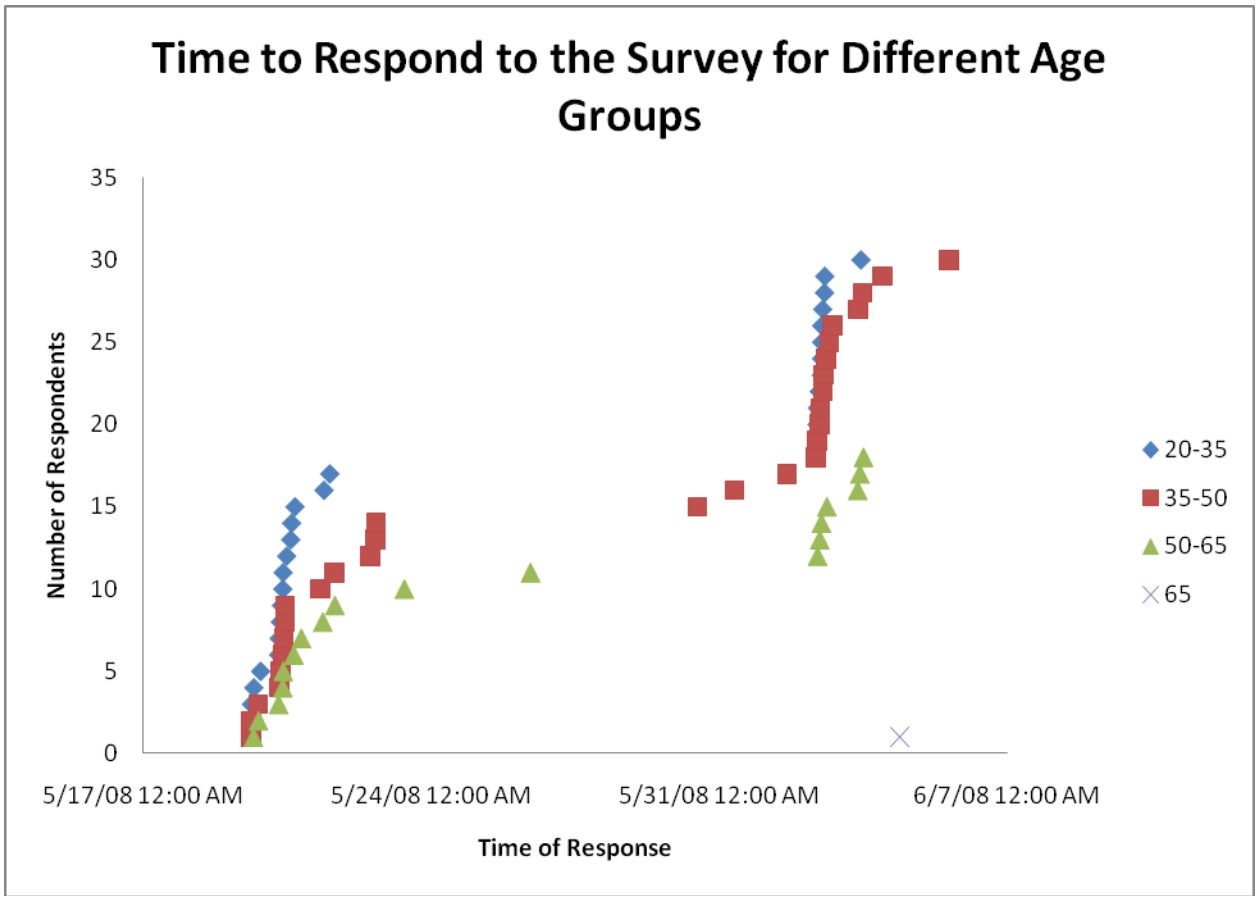


Figure 21 Age vs. response time for primary teachers

Younger primary school teachers preferred to be contacted via email. While as the age of teachers increased they tended to prefer more traditional, non-electronic, means of communication. This follows the trend shown in Figure 5 where as age increases, internet

usage decreases.

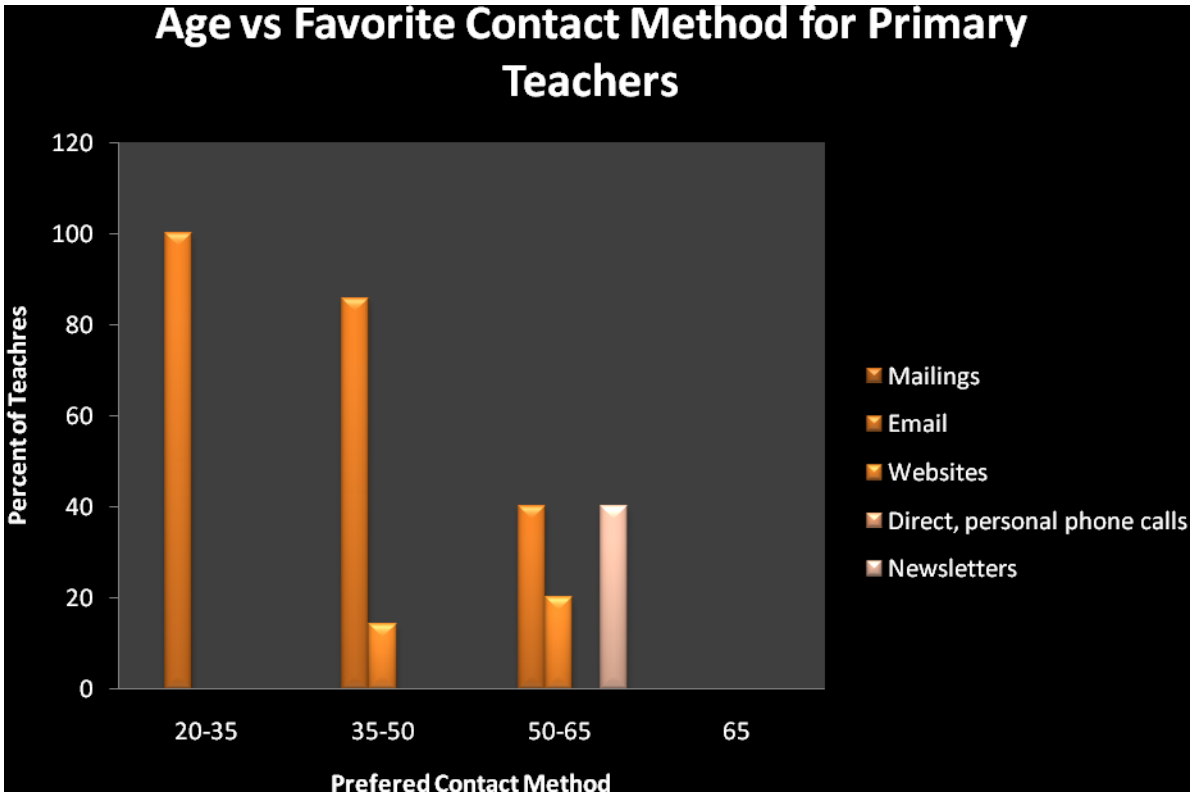


Figure 22 Age vs. Favourite Contact Method for Primary Teachers

In the email introducing teachers to the survey, the group predicted the survey would take about five minutes. This proved true with the primary school teachers, with the majority of teachers answering the survey in less than four minutes. Figure 23 shows how the age of teachers affects how long it takes them to respond to the survey. Teachers aged 35-40 took the survey in both the shortest and longest time, yet there is not a noticeable trend between age and time it takes to respond.

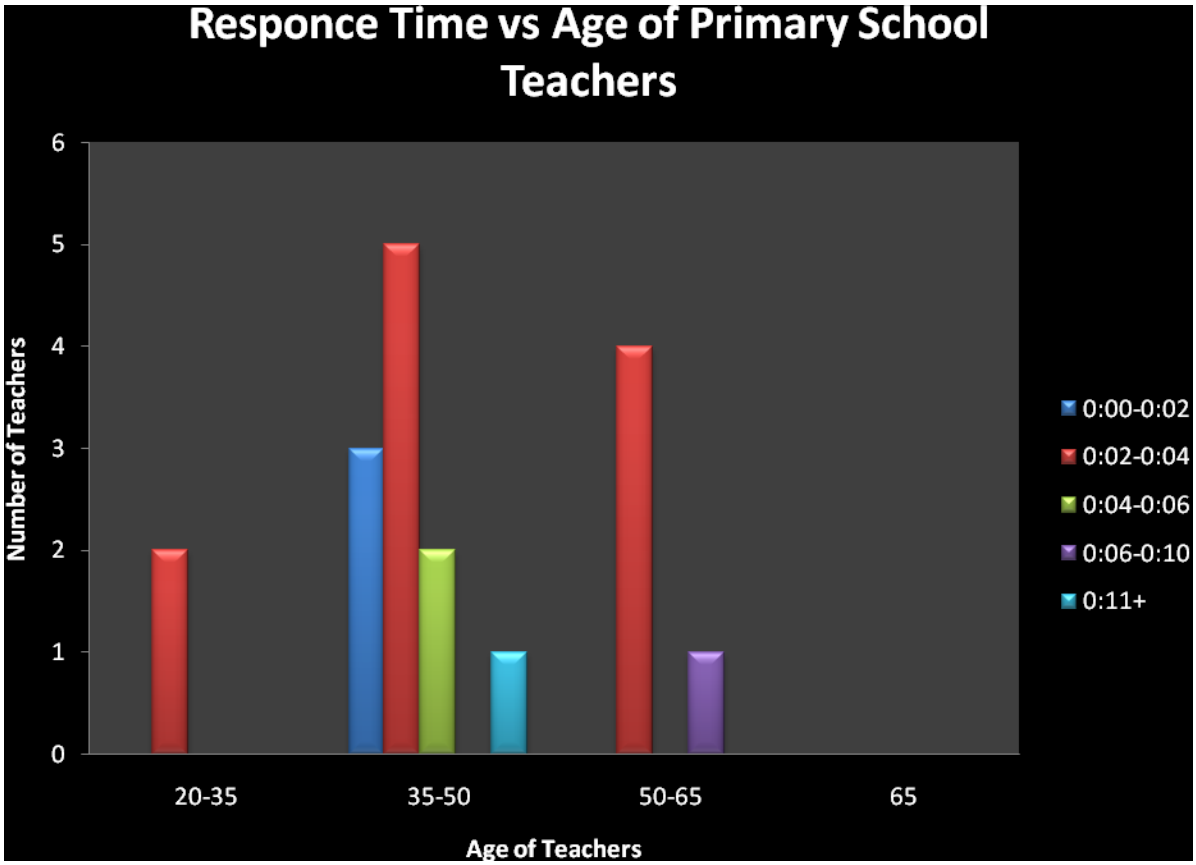


Figure 23 Response Time vs. age of primary school teachers

4.2.4.2 Secondary Schools

To find what influences teachers to respond to the survey, a map was created to see how many emails were sent versus and how many were returned. Postal districts near the Tower of London did have a slightly higher response rate. All 6 postal districts that had the highest response rate (4 to 5) were within 129 km miles of the school, with 4 being within 58.7 km.

Figure 24 also shows that the group was able to send a survey to at least one school in each postal district. This proves that our database creation method created a list of schools that accurately represented England. It can be assumed that the data gathered is an accurate representation of secondary school teachers in England.

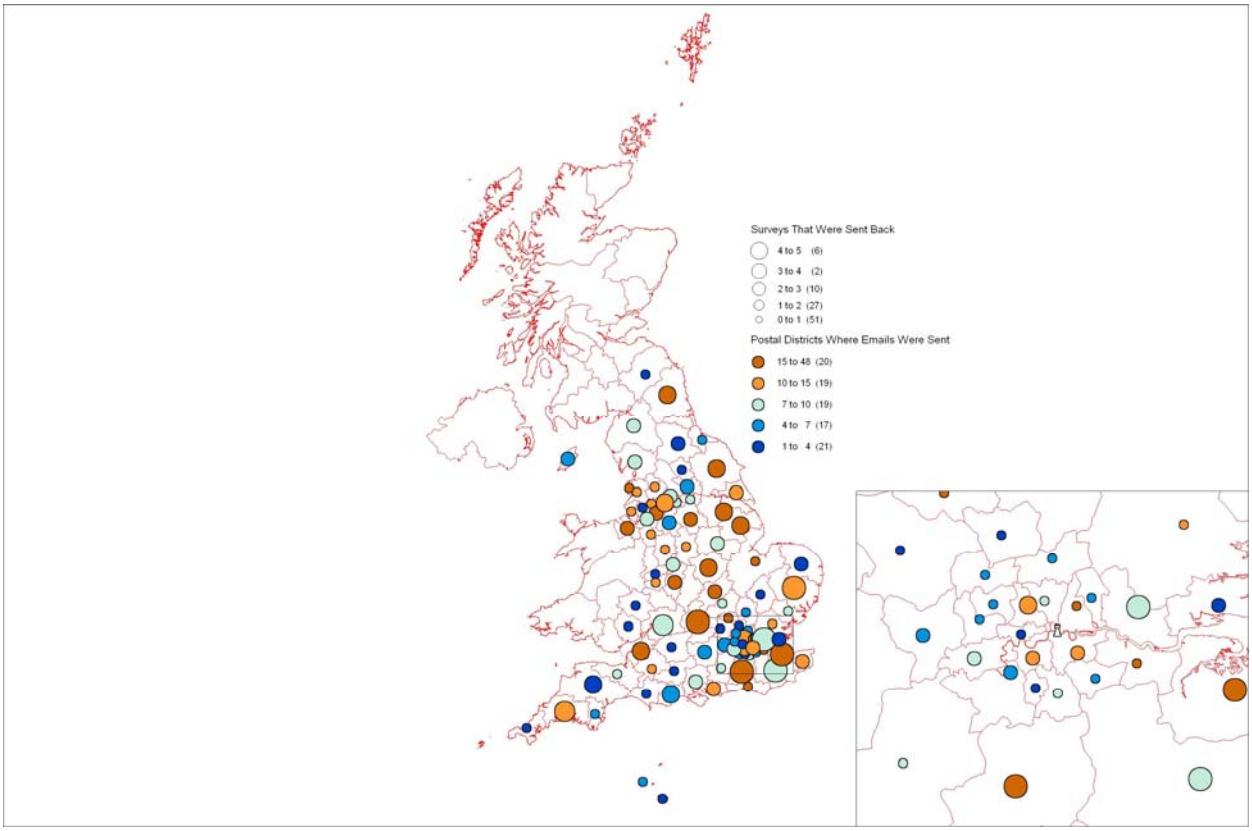


Figure 24 Emails sent vs. surveys done by secondary schools

All of the schools that were not interested in the loan box programme were fairly far away from the Tower of London, which is one possible explanation for what could be dissuading them from using the programme. Additionally, a majority of schools that are not interested in the loan box programme have never used an outreach programme before, which may be another reason some schools demonstrated a lack in interest. Surprisingly though, there is no noticeable difference between the distance from the Tower of London and how schools would use the programme. Schools are just as likely to use the loan box programme in lieu of a visit to the museum if they are near London versus those that are far away from London. Even in the most northern parts of England, there are still schools that would like to use the programme before and after a visit to the museum.

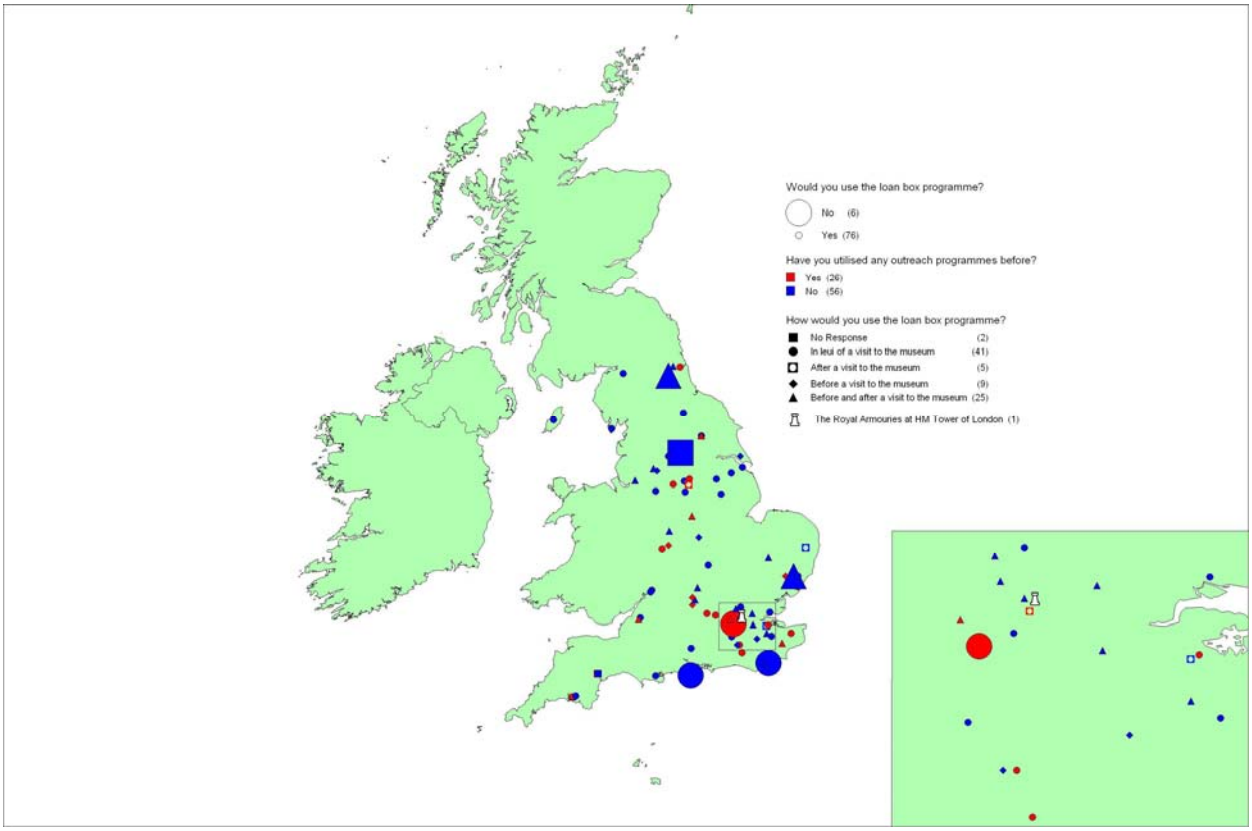


Figure 25 Map of secondary school teachers that answered the online survey

Additionally, there is no real correlation between distance and a schools ability to pay for transportation of the loan box. One school that has the funds to pay for transportation of the loan box but is not interested in the programme is over 170 km away. Also, there are schools about 2 km away from the Tower that are interested in the programme but can not pay for transportation of the loan box. One explanation for this is that since no price per km was suggested in the survey, these responses might not be an accurate representation of whether a school can or can not pay for transportation of the loan box.

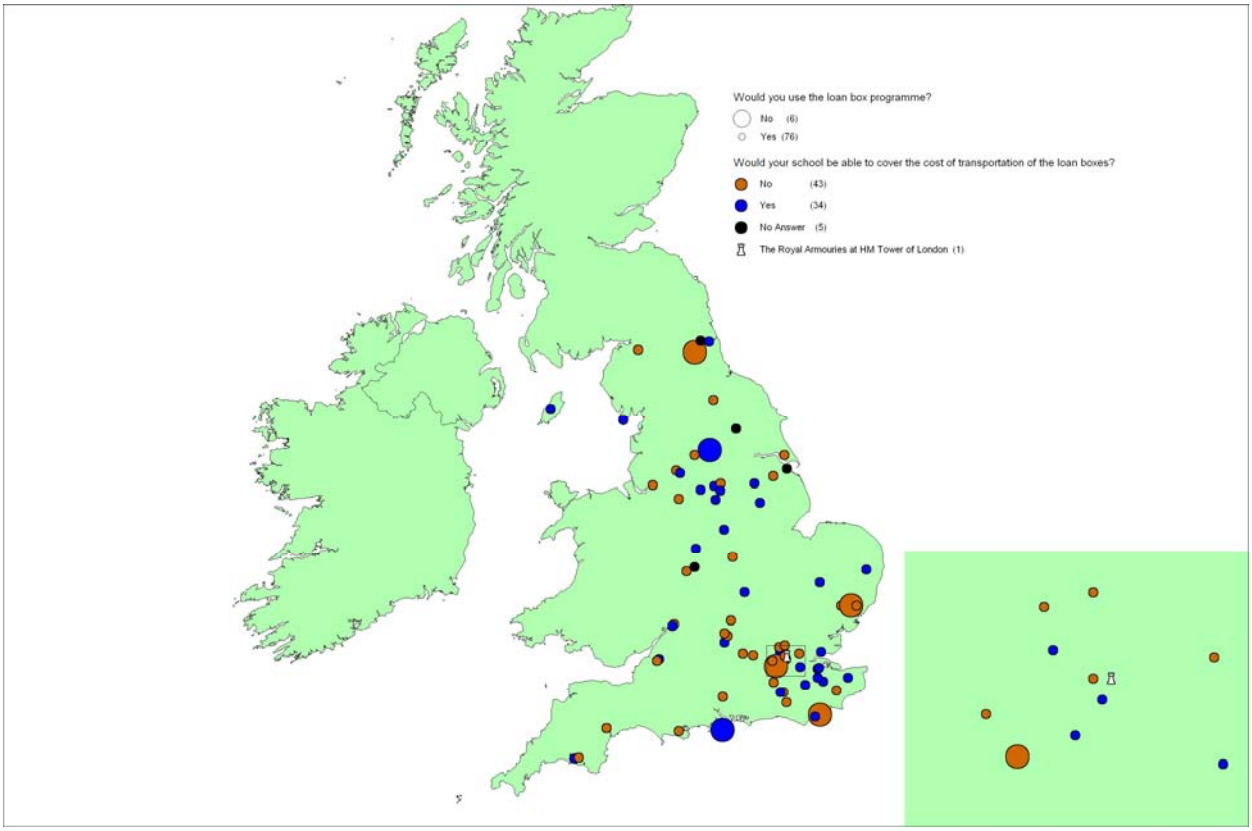


Figure 26 Secondary School ability to pay for transportation vs. interest in the programme

Figure 27 shows the correlation between the ages of science teachers and their favourite contact method, where it is clear that teachers responded overwhelmingly in favour of email. Unfortunately, this data does not represent science teachers as a whole since the survey was delivered via email, which may have skewed the data. To gain more impartial results, the survey would need to be conducted using a variety of different methods. Unfortunately, this was not possible with the time and resources available. Surprisingly, this data does not follow UK internet usage statistics. UK residents between the ages of 25-44 are the second largest users of the internet, yet secondary school teachers in this age group are more likely to favour a more traditional form of contact than any other age group.

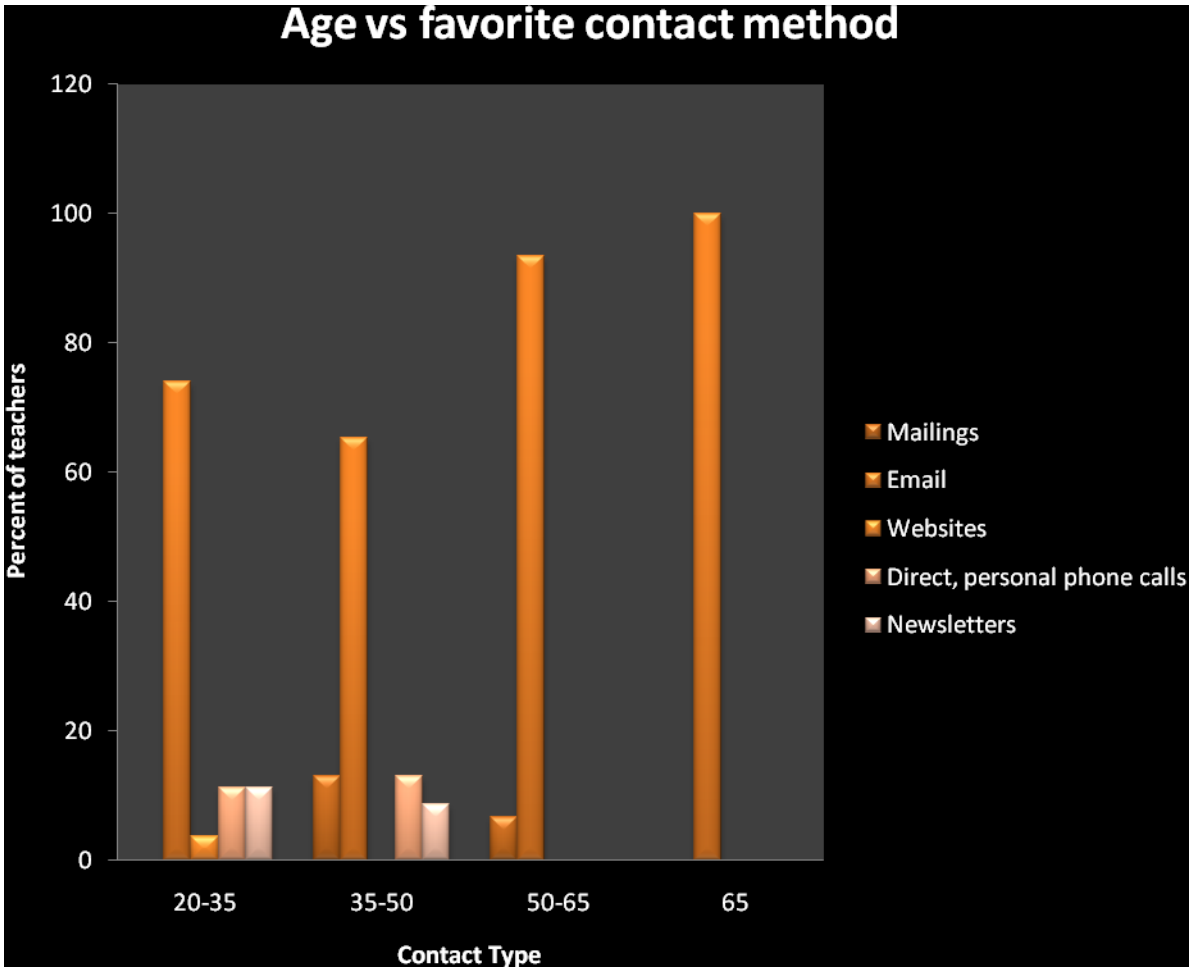


Figure 27 Age of secondary school teachers vs. favourite contact method

Figure 28 represents the time it takes for Science teachers from different age groups to respond to the online survey. Teachers aged 20-35 are the quickest to respond, with most replying within a few days of the survey being emailed out. On the other hand, teachers aged 50-65 took longer to respond, some taking several weeks. This fits with UK internet use where younger people tend to use the internet daily, where as the older generations tend to use the internet more on a weekly basis. (Pollard, 2007)

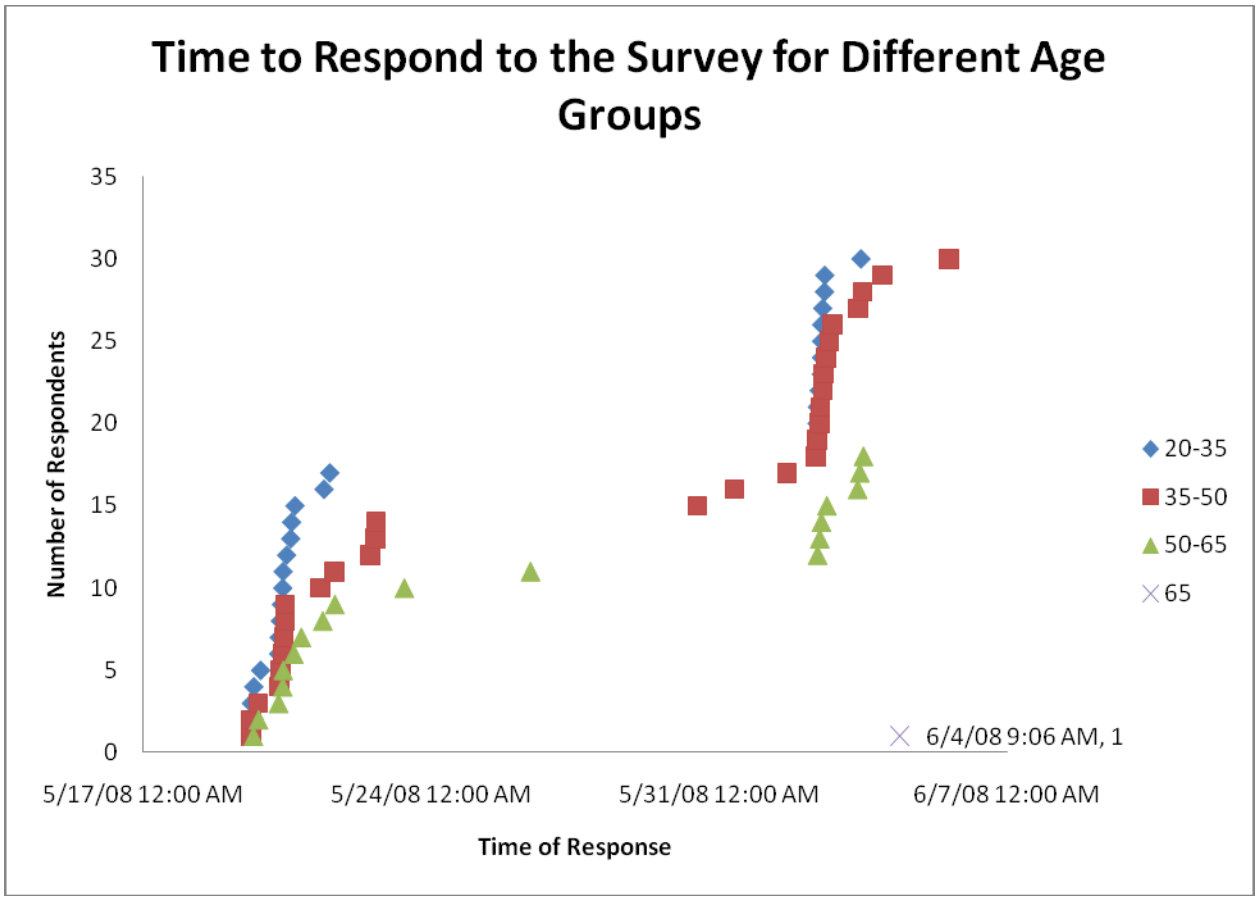


Figure 28 Response time for different age groups

Figure 29 shows how long it took teachers from different age group to complete the survey. Since the group estimated it would take five minutes to thoughtfully complete the survey, the group wanted to quantify the quality of responses through the time taken to complete the survey. A majority of the teachers aged 20-50 were able to take the survey in less than 4 minutes. Teachers aged 50-65 tended to take a bit longer, between 4 and 6 minutes. These results indicate that the survey was doable in the allotted time, and that answers from the entire surveyed demographic were thoughtful and statistically significant. Additionally, these results indicate that the older teachers may have more time to review material to incorporate into their classroom.

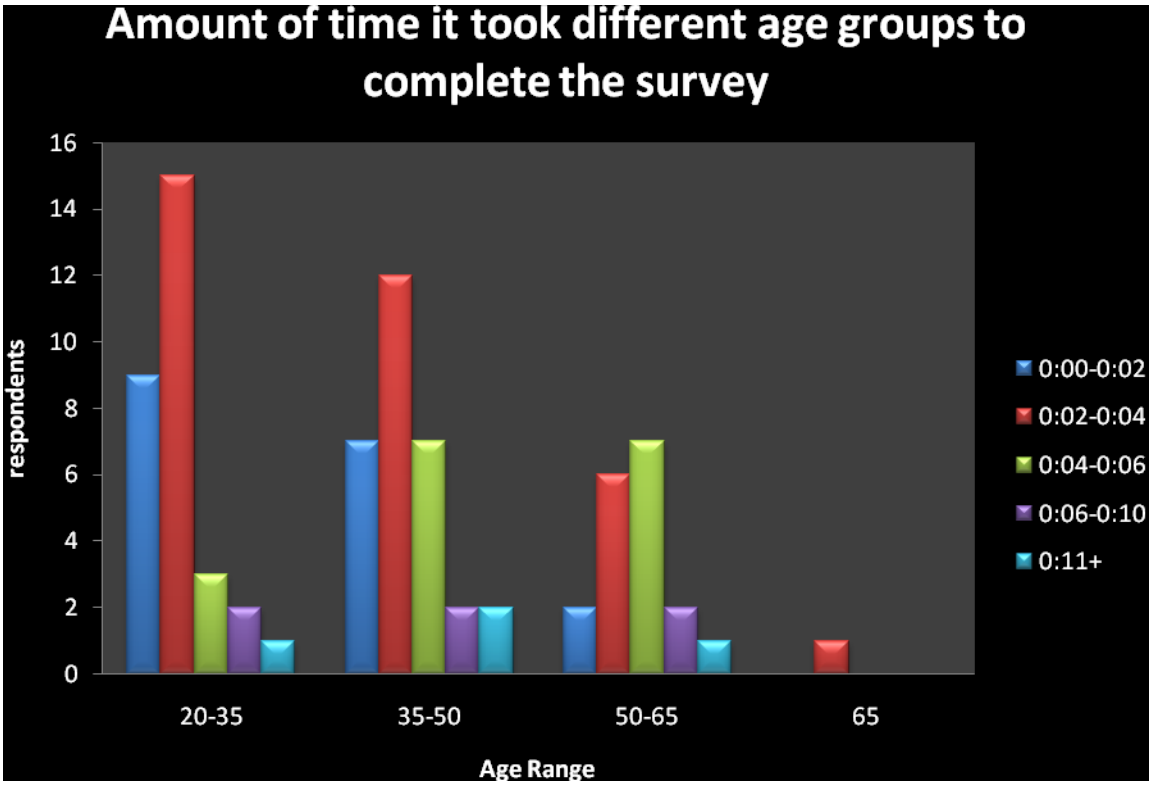


Figure 29 Amount of time it took different age groups to complete the survey

4.3 The Polymer Box

This section focuses on how the group prepared the lesson plan for teaching the polymer box, what happened in the classroom, and also feedback from teachers. By obtaining this information through first hand knowledge they hoped to be able to make recommendations based on their own experience. Also, interviewing the teachers personally allowed for a flow of discussion and thoughts not otherwise possible via the survey.

4.3.1 Creation of a Lesson Plan

The creation of the lesson plan by the group depended heavily on the interview performed with Jasbir and Elena. Feedback from Jasbir gave the group more insight into how a classroom functioned and the feasible amount of work they would be able to accomplish. Also, by performing the experiments in the vaults at the Tower of London before going to the school, the group was able to better grasp both the difficultly level and the amount of time necessary

to finish the experiments. Performing the experiments in the vaults also allowed the group to grasp the scientific concepts behind each experiment so that they would be able to explain it to the students. Lastly, the group examined the previous project's booklet and suggested a lesson plan. After combining all three of these experiences it became clear that the booklet's suggestions might not be feasible to perform in a classroom, and may needed to be changed to best optimize the loan box for a classroom setting.

First the group spoke with Jasbir about possible teaching methods and to gain an understanding of how the classroom worked. Jasper is a teacher who the group met with before putting together the lesson plan. He teaches key stages three, four, and five, with an average of twenty to thirty kids in his classroom. He has visited the Tower before with his students and had seen the polymers box after it was completed. The top two ways he believes school should be contacted are through e-mail and mailings. Jasbir thought mailings are a good idea because it passes through the office, and anything that physically comes into the school makes more of an impression.

The group also asked Jasbir about how the loan box should be presented to students. When asked whether he would use the box in lieu of a visit to museum, before a visit, after a visit, or both he suggested the most practical would be to use it first and then come to the Tower to see the concepts in action. Also, he highly suggested having an education officer to help aid in the teaching of the box, because kids are more receptive to seeing someone new.

He also provided the group with various suggestions on how to teach in the classroom. Show-me boards are a popular way to find out how much students know. Each student is given a small piece of white board on which they write their answer and then hold it up. Also, use of spaghetti or Lego's to distinguish how polymers are constructed may be useful. Discussion topics should include oils and polymers, environmental factors, and polymers vs. metals. The easiest way to get children interested in the lesson is to relate it to something they know. One example Jasbir gave was cutting a trainer in half to see how it is constructed, along the same lines, car components and cell phones are valuable resources for this kind of lesson. Showing plastic items such as helmets, glasses, and horseshoes will help hold their attention. At the end

there should be an assessment of some kind to determine how much group has learned can be evaluated.

Performing the experiments themselves led the group to make a few conclusions about the validity of education value. (All experiments can be seen in Appendix J – Experiments) The idea of using Balloon Kebabs as an attention getter was valuable, but the group felt as though more explanation might be required. Another visual is needed to discuss how exactly the balloon does not pop. Makein' Casein without baking soda was the easiest to understand and the easiest to perform. The bonus being there was an end product which the children could both take pride in as well as actually physically interacting with a material. Makein' Casein with baking soda was not particularly successful and less rewarding, and was possibly beyond the level of chemistry understanding that children this age would have. Secret State was fun, but not something the group decided was appropriate to have the children made themselves. It would take just long enough to disrupt the flow of the lesson, and so it would be beneficial to have it pre-made and have them still get the experience. Melting polystyrene was dangerous to have year eight and nine children doing because of the use of acetone. Also, when we performed the experiment it was questionable what the educational value was as well as if their knowledge was advanced enough to understand this experiment. Last but not least the group examined Protecting the Future. This experiment required too many things and the educational value in relation to polymers was questionable. Creating armour would be a fun activity but the group felt as though there were other experiments in the box that could better exemplify the points that the polymer box was trying to teach.

Finally, the group examined the booklet that accompanies the polymer box and the proposed lesson plan. The proposed lesson plan was to do three experiments a day plus lecture. Maximum time for lessons in England is roughly 50 minutes from both our conversation with Jasbir and by performing the experiment, it was concluded that three experiments and lecture are simply too much for one class period. The group decided to create a more feasible lesson plan that could be performed in one day in a 50 minute class combining the information received from Jasper as well as the knowledge they had of the box and polymers.

The first task was to come up with an informative introduction that both caught the attention of children and educated them. The Balloon Kebabs was an excellent attention grabber and exemplified on the key point about polymers. Polymers are stronger when there is not tension placed on the strands of molecules. When a kebab is poked through a place in the balloon where the plastic is not stretched, the balloon will not pop. When the kebab is stuck in the side of the balloon, however, where the plastic is taut, the balloon with pop. We thought initially that two other models we could use to explain this were Lego's and spaghetti. The Lego's could easily represent molecules and putting them together would represent the creation of a polymer. Whereas spaghetti could be used to accurate describe how the chains of polymers interact with each other. The longer the chains of polymers get the more entangled they become, much like cooked spaghetti, one polymer can't be picked up without getting a whole bunch. These are the models that the group decided were the easiest way to introduce polymers, and also a way that would keep the children engaged.

To make sure that this was an interactive programme the group also decided to include a lot of questions posed to the class. This would not only help keep the children thinking and engaged, but it would also provide the group with a better understanding of how well they knew chemistry and materials concepts already. Jasbir also recommended that there be a few parts in the introduction that the group would ask for volunteers.

4.3.2 Teaching the Polymers Box

To teach the class there were two of members of the group present, Lena and Matthew. The group arrived right after the first lesson had started and were forced to teach out of the box. This created a bit of disorganization that carried on through the lesson. When the lesson kicked off the children's attention was definitely caught, but as the introduction lecture continued the group noted that the material was to advanced for the children to completely comprehend.

Another issue that arose was during the Casein experiment. The group thought that they would be able to walk the class through the experiment step by step. This created an issue because once the groups of three were sent off to perform the experiment it was really difficult to grab their attention again. Also, being late left the group unable to set up for the experiment

beforehand and so the ingredients had to be measured and handed out which consumed time. Although the education officer that had accompanied the group, Elena, tried to talk to each of the children to ensure they knew what they had made, the group was unable to have a class room discussion about the experiment.

In between the sessions the group had time to sit with Elena and analyze how the lesson had gone. The first thing discussed was the initial models; using both the Lego's and spaghetti became confusing for the children. After evaluating educational value and ease of understanding of both models, the spaghetti model was deemed the easiest to use and understand. It also supplemented the explanation of Balloon Kebabs better. To introduce the lesson and get the children engaged right away the introduction was also discussed. The group decided to use an introduction that was cross curricular and got the children thinking about what was around them by asking, "Many eras in history have been named after metals, can anyone give me and example?" After this the children would be asked, "What do you think the era we are living in now would be called?" By doing this they were hoping to achieve more reliability instead of going straight into the chemistry of polymers.

The method used to introduce the experiment was also altered. The first experience in the classroom taught use that the ingredients needed to be measured out and ready to be collected. Also, the instructions need to be shown step by step before the experiment. Elena suggested that Matt and Lena walk around and ask children about what they are doing to see if they are grasping the concepts and getting a better understanding about what the students know.

After making these adjustments the second session with the box was taught much more successfully. This time the group was able to do the experiment and discuss plastics and then environment afterwards. Although it got slightly tangential because the lesson plan was going so much better then the first session. Teaching in the classroom taught the group valuable lessons about the amount of time available when contended with younger children and experiments. It also helped refine the lesson plan because they were able to see the concepts that worked and the concepts that didn't.

4.3.3 Interview with Teacher after Lesson

After the lesson the group approached the teacher for input on the program. The first question asked was whether or not she would use the programme in her curriculum after seeing it in action, the answer to this question was yes. Then they inquired about the strong and weak aspects of the lesson. The strong aspects of the lesson noted was that it was practical and new, also that it joined theory and practice so it was easier for the children to connect with the concept. The one weak aspect she commented on was the lack of examples of plastics. The group also learned that the teacher would rather have a complete lesson plan included in the box. Her reasoning for this was that she did not know much about plastics in material science and without the complete plan; she didn't think she would have the knowledge to teach the box very well. Finally, for comments on the lesson plan, she noted that the lesson plan would be good for year nine kids, but for years six and eight the lesson would need to be a little more simplistic.

The teacher also mentioned that the making casein experiment says the participant should warm the milk without boiling. How close you get the milk to boiling without actually letting it boil affects how well the polymer precipitates out of the liquid. So instead the group should change this to be a specific temperature. If the students are told to warm the milk to a specific temperature, then the experiment is more likely to succeed

4.3.4 Interview with Teacher about Future Plans

Due to a response from the e-mail survey the group was given the opportunity to interview with another teacher. He travelled from East London to meet with Amy about doing programmes both within the Tower and outside of the Tower. Group members were allowed to sit in on this meeting and ask questions related to usability of the polymers both in a classroom setting.

The primary reason for his visit to the Tower was concerning a summer programme he was looking to host outreach at. The programme is called a "science school" and it is hosted over the first two weeks of summer break. Fifty children are chosen based on recommendations from their primary school teachers. They often call the programme one for gifted children, but in reality it is based on interest in science. This also means that the group of

children that participate in the programme are of various skill levels and abilities. The teacher visiting the group comes from the secondary school chosen to host the program. For every ten children there will be a head teacher, three year ten mentors, and two science technicians. The general set up of the programme is to do coursework in the morning and have presentations in the afternoon.

During the year he teaches applied science classes at the secondary school level. These are meant to get children interested in the sciences and relate them to their ambitions. The main target of one of the three that he teaches is 21st century science. Fifty children are chosen for these classes, and one of the dominant criteria is attendance. Attendance is a large issue at his school and 66% of the class is based on coursework. Children should also work well on their own. These criteria mean that the class is very mixed in ability. In this class they are given assignments and allowed to interpret them. When writing up the result they are graded in levels, depending on how much they analyze the issue and try to come up with feasible solutions. There are seven assignments given to year ten students and five to year eleven because of exams their school year is considerably shorter. The basic idea is to try and give two in biology, two in chemistry, and two in physics. He would love to use a concept like the polymers box as part of an assignment in the chemistry component.

When the group members were given the floor to ask questions, one of the first they posed was whether he would prefer to be given lesson plans that were pre-made or just to received the experiments with a loose lesson plan and design his own. His choice was to create his own lesson plan. He has been teaching for over twenty-five years and would prefer to take out what he wants from the programme. As an afterthought he did note that for newer teachers they would probably need more direction, so these teachers may prefer a more detailed lesson plan. Someone to accompany the box would also be ideal so that the children may participate in a handling session. He believes a concept is is much easier for children to grasp if they can see and experience it first hand.

One suggestion he had for promotion of the programs offered by the Royal Armouries is to have a teachers evening. Greenwich recently held one and it was well attended, it was booked completely. Having an evening event allows teachers to do it on their time. Inset days

are ok but limited because they are prescribed by the school. It ends up being more a pain to arrange the schedule to do an inset day.

Although the programs offered by the Royal Armouries are always cross-curricular by nature because of the armour handling and element of historical significance, the group was hoping to expand on this after witnessing a trend forming in the surveys. The group asked about cross-curricular learning and how to best present this. The main foreseeable problem with this idea is that in secondary schools the children and also teachers have become more compartmentalized. It is a lovely idea but the issue is that teachers have so much to do in their own departments they do not have time to leave their own areas and coordinate with other teachers. One solution to this is theme days. Some schools will dedicated a day to a cross-curricular programme and make it a theme day. Due to the fact that he was drawn in for a meeting from the groups e-mail survey they opted to end the interview without asking him any questions from the survey.

4.4 Student Feedback & Curriculum Correlation

The student feedback was analyzed by the group by taking qualitative data and making it quantitative. In order to do this the responses were evaluated based on the how many children wrote down a certain statement. Given they did not all write the same things, keywords were looked for in some cases such as milk, vinegar, and plastics, the group also evaluated the classes separately because both lessons were taught differently. The concepts that were supposed to be taught by Makin' Casein and Secret State at key stage three are compounds and mixtures, using chemistry, simple chemical reactions.

The first lesson when the group was unable to perform Secret State as an experiment 52% of the children noted they learned that milk makes plastic. The group was hoping for more in depth answers and in order to achieve this, a survey would have had to have been done. This was something that was contemplated by the group, but due to time constraints in the classroom the group decided this would probably not be the most efficient way to take data. After adjusting the lesson plan and also teaching children one year older, 83% of children displayed an understand of creating polymers out of milk and vinegar. The concept covered

here was simple chemical reactions and it seems to have been understood better by the year nine students. This confirms the input received from teacher interviews on the matter.

Another notable is the fact that 30% of the students from the second group wrote a comment related to plastics and armour, and nine percent made a comment related directly to shear thickening fluid. Also, 35% wrote down a comment related to plastics and the environment. This is a vast improvement when compared with the first class. Many of the comments written by the first class included things such as, milk and vinegar smell bad when mixed together, how to make rotten milk, and you can poke a kebab through the bottom and top of a balloon without popping it. These findings confirm the opinions the group was given by the teachers the group spoke with after teaching at the science club. Also, the comments given by the second group gave more scientific responses then the first group. The improvements in the group's lesson plan created a better understanding of the topic.

5 Conclusions

Through the groups' methods and results, common themes have emerged in the feasibility study. The following discussion is a result of the trends that developed and the implications the group believes they present for the laon box and how it should best be promoted to encourage teacher usage.

5.1 Museum Interviews

Museum interviews allowed the group to establish a baseline for how teachers have been contacted and engaged by other museums, how their programmes are used, what their programmes consists of, and what might be the best way to approach surveying, interviewing, and gathering feedback from teachers. Additionally, the process of interviewing museums aided a great deal in the development of the project and the direction and approach the group chose to take overall.

There were concepts that showed up pre-dominantly in the museum interviews that have helped them to create successful outreach programs. One of which is the achievement of private sponsorship. Tax breaks are given on money that is donated or spent on educational programs. In some cases the companies will approach the well known and larger museums to basically offer them money towards their outreach. Smaller museums often have to go seek their

financial support because they are lesser known. In all cases this alleviates the financial burden from the school and allows the museum to reach more schools.

It was easier for the museums to target audiences outside the city. This was the case both with museums in Boston MA, Worcester MA, and London UK. The suburbs right outside the city are often very easy for the museums to reach but the schools can not easily reach the museums. These are the areas that the museums target because they have limited resources available. Often the schools are aware of how helpful these programs are and have become a reliable client base for all the museums interviewed.

Another recommendation heard from more then one of the museums would be to have a teacher programme. Many of the museums send out mailings and/or e-newsletters. In order to successfully reach teachers the easiest way is to have them sign up and provide contact information. Mailings have been successful for two of the museums interviewed and e-newsletters have been successful for two of the museums. Both are viable forms of communication with teachers and an easy way to ensure that the programs and museum stay in the teachers minds. Most of the museums interviewed also built their relationships through personal contact, such as phone calls and attending educational events.

5.2 Correlated Survey Data

Data from primary, secondary, and cold-called teacher surveys has provided the necessary information to draw conclusions from and make recommendations on how to change the current loan box programme to best meet the needs of teachers and students. Through the analysis of the data several primary themes regarding the current loan box emerged. Additionally, through comments and concerns in the open response section of the surveys, the group was able to gain valuable insight into how teachers would use the programme, how they would like to interact with the Royal Armouries, and what they value in an outreach programme. Foremost, it should be mentioned that nearly all of the survey respondents were interested in the programme and wanted further information on it.

The first concern that arose through the surveys was the method of contact. Surprisingly, teachers preferred to be contacted via email or other electronic means, rather than through post. This valuable insight has lead the group to draw the conclusion that while it may be

effective to contact teachers via phone or mail, the greatest number of responses are going to be achieved via electronic communication, such as email at the least cost both in labour and money.

Additionally, the group found that teachers needed a minimum of 6-8 weeks before they would be able to incorporate any outreach programme into their classroom. Identifying this, the group has determined that the Royal Armouries must direct their efforts toward contacting teachers in a timely fashion, and focus several months ahead of when they would like a teacher to utilise the programme in the classroom. Although the timeline would traditionally be running 2 months ahead of actual usage of the loan box, this time could perhaps be reduced as teachers become experienced with the programme, and could be substantially reduced if a teacher uses it on a recurring basis.

The group also found that the programme, as currently implemented, might cost too much. While it would be convenient for the Royal Armouries to simply ship it to schools, the cost associated with this may be too great of a burden on schools. Almost half of all schools stated that they would not be able to afford the programme, and thus in spite of all the benefits of the programme if the schools that need it most are not able to afford it, than it is useless.

The last critical question on the survey was how teachers would use the programme. While many stated that indeed they would use it in lieu of visiting the museum, many also stated that they would use it as a supplement to visiting the museum. Recognizing this, the group believes that teachers have identified that any resource available which may help to reinforce concepts learned in the classroom or outside of it, is invaluable to teaching students. Through this method of reinforcement, the Royal Armouries stands the greatest chance of teaching about armour and armaments from a science-perspective and promoting what they do to preserve history.

The survey provided invaluable data, which the group hopes will help the Royal Armouries better market and tailor the loan box programme to teachers. The programme is feasible, so long as it is changed to meet the needs of teachers as they see fit. It must encourage students to learn through hands-on experiences, and develop an interest in the sciences through an experience which is unique and memorable.

5.3 Segmented Survey Data

Their is no correlation between a schools distance to the Tower of London and their interest in the program. This is assumed since distance does not effect whether schools would use the loan box in conjunction or in lieu of visiting the museum. This means that schools did not take into account their distance from the Tower of London when filling out the survey. Also, many schools that did not want to use the loan box programme had the ability to pay for transportation of the loan box to their school.

Age plays a role in how quickly teachers answer the survey and how long it takes them to complete the survey. As age increases, both the time it takes to answer the survey and complete the survey increases. This is not surprising since older UK residents use the internet less frequently than younger residents.

Age also effected how teachers would like to be contacted. While all teachers voted overwhelmingly in favour of internet communication, Primary and Secondary Schools had opposite results for other forms of communication. With Primary Schools, younger teachers were more willing to be contacted through other forms of communication such as direct phone calls and newsletters. In contrast, older Secondary School teachers preferred other forms of contact more than younger teachers.

5.4 Recommendations

Through the surveys, it was discovered that the easiest method to reach the greatest number of teachers was via email. They overwhelming preferred to be contacted this way, and responded promptly to the survey requests where initial contact was made via email. Since this is the case, the group would recommend that to continue building the loan box programme and to encourage its success, the Royal Armouries should first utilise the list of approximately 100 teachers contact emails and information to continue the dialog regarding the loan box. After that list has been exhausted, the group would then recommend continuing to reach out into Great Britain by contacting teachers through large-emailing campaigns, such as that which was first undertaken to send out the surveys. The group believes that if the marketing effort is

carried out in this fashion, that it is both accomplishable by the current staff and can occur efficiently.

Additionally, the group recommends that the Royal Armouries begin contacting teachers from the list of teacher contact information that resulted from the survey within the next month (July, 2008). Teachers expressed that at a minimum they needed eight weeks to incorporate the loan box programme into their curriculum, but that it would be best to incorporate it in the summer, before the next school year. If the Royal Armouries contacts teachers in the next month, they should be able to begin running a pilot programme for the loan box, encourage interest, and inspire teachers to use it.

Producing an e-newsletter would also be advisable. At first once an academic year as both a marketing tool and to use as a reminder, and eventually maybe 2 to 3 times a year. This e-newsletter could talk about what the Royal Armouries has done, what they intend to do in the following year, and welcome teachers to take an active role in their outreach programs. Many museums have found this to be a successful way to keep in touch with teachers. Although it is not as personal as a phone call or a visit, it keeps the Royal Armouries and their programs in their mind. This could become more useful with time as the programs begin to experience more success.

Based on the input received from other museums with outreach programmes one thing the Royal Armouries might also want to consider is having an educational officer travel with the polymer box. The Museum of Science felt strongly that something special was needed to create a desire to use outreach programmes. An armour handling session to accompany the lesson and make it cross circular would be ideal. This is also reinforced by the surveys. Many teachers asked for a cross curricular program. According to the surveys not all teachers desired an education officer to assist in teaching the box but after teaching in the first classroom and speaking with that teacher the group believe it would be beneficial.

The additional information provided in the polymer box does not fulfil what teachers have requested to supplement the box. The group also found that the suggested lesson plan to not be feasible with the length of the classes and is a assuming a more advanced knowledge in material science then most students possess. By taking each experiment and classifying them

by appropriate year the students will take away the most from the lesson and also the curriculum will more accurately be fulfilled. Experiments should be evaluated on levels of appropriateness for years 7, 8, and 9, and then a complimentary plan should be put together combining both history and the concept of the experiment. For example the experiment "Protecting the Future" would be a good concept to cover with children in year 7. This experiment would expose them to the mechanical properties of materials while still being fun. There are other experiments more suited to students of year 8 and 9 such as Makin' Casein. The group has put together a sample lesson plan including Makin' Casein. To be more effective this box could be accompanied by a handler with objects, just as many of the lesson plans would be.

The national curriculum in England is constantly changing. In order for the loan box to remain relevant, applicable, interesting, and engaging, the Royal Armouries must continue to ensure that it fits into the curriculum. The group found that through interviewing teachers a wealth of information on how the programme fit into the curriculum and could best address the needs of students and teachers was learned. The group would suggest that the Royal Armouries establish a small group of teachers who would be willing to be regularly contacted about the loan box, its progression, new ideas, and educational fulfilments.

Lastly, the group hopes that the Royal Armouries can use the results of the surveys, teacher interviews, and museum interviews to continue building this programme. The data shows that if this programme can be funded through a sponsor, students across Britain will benefit from a programme which is engaging and inspiring.

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Appendix

Appendix A: Polymer Loan Box Educational Fulfilments

Experiment	Examination Board Standards
Balloon Kebabs	**Key Stage 3:** **QCA** Science Standards: Unit 8E (atoms and elements) **Key Stage 4:** **OCR** Science in the 21st Century: Science Suite Science in the 21st Century: Chemistry A Chemistry – Structure and bonding **QCA** The properties, characteristics, and features of materials that affect: ○ ability to be shaped and formed ○ ability to be treated ○ ease of handling ○ availability, form and supply
Polymer Hands-On Demonstration	**Key Stage 3:** **QCA** Science Standards: Unit 8E (atoms and elements) Unit 7K (forces and effects)

	D&T Standards: Unit 08aii (Exploring Materials Focus: Resistant Materials) **Key Stage 4:** **OCR** Science Guide Sections: o Chemistry – Structure and bonding **AQA**: Unit Chemistry 1: 11.1 – How do rocks provide building materials? 11.3 – How do we get fuels from crude oil? 11.4 – How are polymers made from oil? Unit Chemistry 2: 12.1 – How do sub-atomic particles help us to understand the structure of substances? 12.2 – How do structures influence the properties and uses of substances 12.3 – How much can we make and how much do we need? 12.5 – Do Chemical Reactions always release energy? **QCA**: Engineering materials and the properties in the following groups: • Polymers • Composites that combine the properties of different materials The properties, characteristics and features of materials that affect: • Ability to be shaped and formed • Ability to be treated • Availability, form and supply **EDEXCEL**: Module 4: Chemistry in Action Topics: • Crude Oil • Plastics • Types of Chemical Reactions
Makin' Casein	**Key Stage 3:** **QCA** Science Standards: Unit 8F (compounds and mixtures) Unit 9H (using chemistry) **Key Stage 4 (GCSE Standards):** **GCSE Standards:** **OCR** • Chemistry – Structure and Bonding • The Unique Properties of Water – Electro negativity, exchange of electrons **QCA** • QCA Engineering Materials – Polymers, Composites that combine the properties of different materials • The properties, characteristics, and features of materials that affect: o ability to be shaped and formed o ability to be treated o ease of handling o availability, form and supply **AQA**

	• 12.5 – Do Chemical Reactions always release energy? • 13.2 What are strong and weak acids and alkalis? How can we find the amounts of acids and alkalis in solutions? • 13.4 How much energy is involved in chemical reactions? **EDEXCEL**: Module 4: Chemistry in Action Topics: • Enzymes
Secret State	**Key Stage 3:** **QCA** Science Standards: Unit 7F (simple chemical reactions) Unit 8F (compounds and mixtures) Unit 9H (using chemistry) **Key Stage 4 (GCSE Standards):** **OCR** • The Unique Properties of Water – Breaking and Forming bonds through condensation and evaporation **QCA** • Engineering Materials – Polymers, Composites that combine the properties of different materials • The properties, characteristics, and features of materials that affect: o ability to be shaped and formed o ability to be treated o ease of handling o availability, form and supply • Engineering processes: o Shaping and manipulation o Heat and chemical treatment • New technology used in and by the engineering industries o Modern and 'smart' materials and components • The Impact of modern technologies o Advantages and Disadvantages that the use of modern technology has brought to society • Engineered products: o Investigate a variety of engineered products that use modern technology **AQA** • 11.4 – How are polymers made from oil? • 12.1 – How do sub-atomic particles help us to understand the structure of substances? • 12.2 – How do structures influence the properties and uses of substances • 12.5 – Do Chemical Reactions always release energy? • 13.2 What are strong and weak acids and alkalis? How can we find the amounts of acids and alkalis in solutions? • 13.4 How much energy is involved in chemical reactions?
Protecting the Future/Nanomaterials and Smart	**Key Stage 3:** **QCA** **Science Standards:** Unit 7K (forces and bonding)

Technology	**D&T Standards:**
	Unit 07aii (Understanding Materials Focus: Resistant Materials) Unit 08aii (Exploring Materials Focus: Resistant Materials)
	Unit 08bii (Designing for Clients Focus: Resistant Materials)
	
	Key Stage 4 (GCSE Standards):
	QCA
	• Engineering processes:
	  o Shaping and manipulation
	  o Heat and chemical treatment
	• New technology used in and by the engineering industries
	  o Modern and 'smart' materials and components
	• The Impact of modern technologies
	  o When engineering a product
	  o On engineered products
	  o On engineering industries
	  o On stages in engineering a product
	  o Advantages and Disadvantages that the use of modern technology has brought to society
	• Engineered products:
	  o Investigate a variety of engineered products that use modern technology
	  o Investigate the impact of modern technology on the design and production of a range of engineered products.
	AQA
	• 11.1 – How do rocks provide building materials?
	• 11.3 – How do we get fuels from crude oil?
	• 11.4 – How are polymers made from oil?
	• 12.1 – How do sub-atomic particles help us to understand the structure of substances?
	• 12.2 – How do structures influence the properties and uses of substances

Melting Polystyrene	AQA
	• Chemistry Section 1
	  o *11.1 – How do rocks provide building materials?*
	• Chemistry Section 2
	  o *12.1 – How do sub-atomic particles help us to understand the structure of substances?*
	  o *12.2 – How do structures influence the properties and uses of substances?*
	QCA (for GCSE engineering)
	• *The properties, characteristics and features of materials that affect:*
	  o *Ability to be shaped and formed*
	  o *Ability to be treated*
	• *Engineering processes:*
	  o *Shaping and manipulation*
	  o *Heat and chemical treatment*
	OCR
	GCSE Science Guide Sections:
	• *Chemical and Material Behaviour*
	• *Structure and Bonding*
	Edexcel
	Module 4: Chemistry in Action
	Topics:

	• *Types of Chemical Reactions*

Appendix B: Museum Interviews

Outreach Programme Interview Questionnaire

Outreach Programme Interview

Date	Museum:

INTRODUCTION

We have contacted you because we are currently working with the Royal Armouries at the Tower of London in England to help promote their materials science outreach programme.

TOPIC AREAS

How is your programme used?

How do you present your outreach?

How many schools have used/use your programme?

Why did you start your outreach programme?

How did you let teachers know about your outreach programme? What did/didn't work?

Outreach Programme Interview – Higgins Armory

Outreach Programme Interview

4/29/2008

Museum: Higgins Armory

INTRODUCTION

We have contacted you because we are currently working with the Royal Armouries at the Tower of London in England to help promote their materials science outreach programme.

TOPIC AREAS

How is your program used?

- As curator the individual we talked to expressed that he may not be able to provide all the information we're looking for.

How do you present your outreach?

- Schools either send students on site, or the museum will send people off site to do a presentation. Programmes are historical for the most part. Use technology to connect science to historical artefacts.

How many schools have used/use your programme?

- The curator didn't know how many schools annually use the programme

Why did you start your outreach programme?

- Been around for a long time (started in 1999). Was part of the development of all aspects of programming for the Armoury.
- Strove to offer options, to increase marketability. Schools are not sending out fieldtrips like they used to (Post 9/11), so it is advantageous to send out material and reach out to schools.

How did you let teachers know about your outreach programme? What did/didn't work?

- They Package the programme in multiple ways in order to broaden the appeal to school groups.
- Set schools up on mailing lists, to let them know about upcoming events.
- They distribute flyers in person to schools
- They also provide Pre & Post programme support—provide things to do with the class after the presentation is over. Utilises the web to present and facilitate the program

Outreach Programme Interview – Museum of Science Boston

Outreach Programme Interview

5/2/2008

Museum: Museum of Science Boston

INTRODUCTION

We have contacted you because we are currently working with the Royal Armouries at the Tower of London in England to help promote their materials science outreach programme.

TOPIC AREAS

How is your programme used?

- Used by schools who want to address science in the curriculum/review science concepts for standardized tests.
- Schools recognize outreach versus visiting the museum are different

How do you present your outreach?

- Mail brochures to teachers
- Phone schools directly and talk about the programme

How many schools have used/use your programme?

- Approximately 283 school districts
- Program costs $3.75 per student versus $7.00 per student to come to the museum

Why did you start your outreach programme?

- Vans got started with actors presenting science, for the purpose of generating revenue for the exam.
- Now mission is to teach and educate students – the organization has been

restructured to facilitate this.

How did you let teachers know about your outreach programme? What did/didn't work?

- Mailers
- Visits to teachers personally/personal letters
- Mos.org/educators [website]
- E-newsletters (12,000 teachers on the list)
- Have voucher programme to bring teachers into the museum for free
- Incentives for feedback – (1) free visit coupon if form is returned (only about 2.5% is used).

Recommendations:

- Cutting cost/making programmes available doubled attendance to the museum.
- Programmes target testing/curriculum
    - Better understanding of curriculum has allowed for greater integration into the curriculum & targeting for teachers.
    - Figuring out what role M.O.S. could play in the curriculum allowed a specifically targeted outreach programme to be developed
- 300,000 students visit annually. 1.4 million total visitors

Outreach Programme Interview – University College of London

Outreach Programme Interview

5/16/2008

Museum: University College of London

INTRODUCTION

We have contacted you because we are currently working with the Royal Armouries at the Tower of London in England to help promote their materials science outreach programme.

TOPIC AREAS

How is your programme used?

- Someone usually goes with the box. It's difficult to do the program/sell it to teachers without someone there.
- Makes school that is going to use it pick-it-up. (free of charge to use)
- There are 12 different boxes available for teachers to use.
- All the loan boxes have specific lesson plans that fit into the national curriculum.
- All loan boxes come with different levels of interaction, so that teachers can choose how they'd like to teach it

How do you present your outreach?

- Don't charge fee for schools to use the loan box (funded through government funds)
- Only work with public school

How many schools have used/use your programme?

- Annually 50 different schools use the programme.

Why did you start your outreach programme?

No answer provided/question not asked

How did you let teachers know about your outreach programme? What did/didn't work?

- Loan boxes only used after meeting personally with teachers who are going to use it.
- Teachers want to know how it's going to help/get integrated into the curriculum
- Did a lot of calling -> went to training days, teacher events.
- Sending faxes proved to be very helpful -> as good as calling, because secretaries could just put it into a mailbox

Outreach Programme Interview – Museum of Science London

Outreach Programme Interview

6/4/2008

Museum: Museum of Science London

INTRODUCTION

We have contacted you because we are currently working with the Royal Armouries at the Tower of London in England to help promote their materials science outreach programme.

TOPIC AREAS

How is your program used?

- Do large scale shows to groups of 100+ audiences
- Do workshops with classes, but teachers stay there while programme is being demonstrated.

How do you present your outreach?

- Have group of 5 staff that go out every day to schools and sell the outreach programmes.
- Have a corporate sponsor for the outreach programme (BP)
- Had a specific programme where they worked with 20 schools intensively.
- Have sponsored outreach too, where schools don't pay for the programme.
- Programmes are first come, first serve.

How many schools have used/use your program?

- Reach somewhere between 100 and 150 schools
- They also work with communities to bring programmes to the community.

Why did you start your outreach programme?

- Been in existence for about 7-8 years.
- Started to address inability of students and schools to come to the Science Museum.

How did you let teachers know about your outreach programme? What did/didn't work?

- Sponsored projects are easier to reach.
- Schools outside London easier to reach.
- Mailings go out to 11,000 schools a year, and direct them to the website too.

Recommendations:

- Sponsors came to the museum and asked how to participate
- Provide resources to teachers that they can't get easily on their own.
- Teachers need all the resources provided for them. If it's not easy to use, then teachers won't use it.
- Teachers tend to be terrified of doing science: have to be confident about their own knowledge.
    - Send report to Alex when it's finished.

Appendix C: Internet-Based Survey

Royal Armouries at HM Tower of London

1. Material Science Outreach Programme Feasibility Study

The loan box is an outreach programme created by the Royal Armouries to aid in teaching material sciences, generate interest in the sciences, and reinforce concepts of material science through hands-on learning techniques. There are currently two loan boxes; a Polymers Box and a Metals Box. Each consists of experiments, aids for interactive teaching, and a teaching manual for further instruction on how the loan box is best implemented with the current science curriculum. There is no cost to use the Polymers or Metals boxes; however, schools are required to cover transportation costs of the box(es).

1. What's you gender?

◯ Male ◯ Female

2. What county [borough] do you teach in?

3. What is your age?

◯ 20-35

◯ 35-50

◯ 50-65

◯ 65+

4. On average how many students are in your classes?

5. What key stage do you primarily teach?

6. Have you visited the Tower previously with your students?

◯ Yes

◯ No

7. Please rank which forms of contact you are more likely to respond to:

	1(least likely)	2	3	4	5 (most likely)
Mailings	◯	◯	◯	◯	◯
Email	◯	◯	◯	◯	◯
Websites	◯	◯	◯	◯	◯
Direct, personal phone calls	◯	◯	◯	◯	◯
Newsletters	◯	◯	◯	◯	◯

Other

8. Have you utilised any outreach programmes or outreach materials in your curriculum before?

◯ Yes ◯ No

Royal Armouries at HM Tower of London

9. When would you need to know about the loan box programme to successfully plan a programme in your classroom?

- ◯ 2 weeks before
- ◯ 4 weeks before
- ◯ 6 weeks before
- ◯ 8 weeks before
- ◯ Other (please specify)

10. Would school incentives increase your interest in the programme?

◯ Yes ◯ No

11. Would your school be able to cover transportation costs for the loan box?

◯ Yes ◯ No

12. Would you use the loan box programme (Key Stage 2, Key Stage 3)?

◯ Yes ◯ No

13. How would you use the loan box programme?

- ◯ In lieu of a visit to the museum
- ◯ Before a visit to the museum
- ◯ After a visit to the museum
- ◯ Before and after a visit to the museum

14. Would you prefer someone to accompany the loan box to aid in teaching it for a day?

◯ Yes ◯ No

15. What supplements would you like to see with an outreach programme (such as a website, teaching manual, homework, PowerPoint presentation, etc.)?

16. How would you like to see the Royal Armouries become more involved with you and your school?

17. Additional comments or questions?

Royal Armouries at HM Tower of London

18. If you would like to be contacted regarding the outreach programme, please provide contact details below:

Name:	
School:	
Address:	
Address 2:	
County/Borough	
Postal Code:	
Email Address:	
Phone Number:	

Appendix D: Mail Merge Emails

Primary School Mail Merge Email

Dear <<name>>,

<<school>>

Please forward this email to the head of your science programme.

The Royal Armouries at HM Tower of London has recently put together two science based loan boxes. One of which is intended to help bridge the science curriculum between years 5, 6, and 7 by introducing children in an exciting way to the new concepts of material science that key stage 3 entails. The loan box is an outreach programme created to aid in teaching material science, generate interest in the sciences, and reinforce concepts of material science through hands-on learning techniques. We are now in the process of determining how to best involve teachers with the loan box programme, and determine what materials they need to best utilise the program. If you have any further interest in viewing this programme, or meeting with us in person please let us know and you will be admitted to The Tower as our visitor free of charge.

Please help us by taking a brief 5 minute survey at:
http://www.surveymonkey.com/s.aspx?sm=b8vcGadsZbpsxMzdSjmYMg_3d_3d

Kind Regards,

Royal Armouries
HM Tower of London EC3N 4AB
020 3166 6671
www.royalarmouries.org

Secondary School Mail Merge Email

Dear <<name>>,

<<school>>

We understand you are very busy and/or may not have received this email previously, but would appreciate the input of a science teacher who may have 5 minutes to fill out the brief survey below.

The Royal Armouries at the Tower of London has recently put together two loan boxes. The loan box is an outreach program created to aid in teaching materials sciences, generate interest in the sciences, and reinforce concepts of materials science through hands-on learning techniques. We are now in the process of determining how to best involve teachers with the loan box program, and determine what materials they need to best utilise the program. If you have any further interest in viewing this program, or meeting with us in person please let us know and you will be admitted to The Tower as our visitor free of charge.

Please help us by taking a brief 5 minute survey at:
http://www.surveymonkey.com/s.aspx?sm=Bvxxo0_2fYT6SiCwGT6bDqTA_3d_3d

Kind Regards,

Royal Armouries
HM Tower of London EC3N 4AB
020 3166 6671
www.royalarmouries.org

Cold-called Personal Mail Merge Email

Dear «School»,

The Royal Armouries at HM Tower of London has recently put together two loan boxes. The loan box is an outreach programme created to aid in teaching material sciences, generate interest in the sciences, and reinforce concepts of material science through hands-on learning techniques. We are now in the process of determining how to best involve teachers with the loan box program, and determine what materials they need to best utilise the program.

Please help us by taking a brief survey at:
http://www.surveymonkey.com/s.aspx?sm=ChbB8nuKvkHN8G0rIIUUfg_3d_3d

If you have further interest in viewing this program, or meeting with us in person please let us know and you will be admitted to The Tower as our visitor free of charge.

Kind Regards,

Royal Armouries
HM Tower of London EC3N 4AB
020 3166 6671
www.royalarmouries.org

Previously Contacted Schools (Past IQP) Mail Merge Email

Dear <<name>>,

<<school>>

We understand that you were contacted about two months ago regarding the new loan box programme the Royal Armouries has put together. The loan box is an outreach programme created to aid in teaching material sciences, generate interest in the sciences, and reinforce concepts of material science through hands-on learning techniques. We are now in the process of determining how to best involve teachers with the loan box program, and determine what materials they need to best utilise the program.

Please help us by taking a brief survey at:
http://www.surveymonkey.com/s.aspx?sm=zC357SfkSHDjmL_2frr8i_2frg_3d_3d

If you have further interest in viewing this program, or meeting with us in person please let us know and you will be admitted to The Tower as our visitor free of charge.

Kind Regards,

Royal Armouries
HM Tower of London EC3N 4AB
020 3166 6671
www.royalarmouries.org

Primary School Mail Merge Follow-up Email

Dear <<name>>,

<<school>>

We understand you are very busy and/or may not have received this email previously, but would appreciate the input of a science teacher who may have 5 minutes to fill out the brief survey below.

The Royal Armouries at the Tower of London has recently put together two loan boxes. The loan box is an outreach program created to aid in teaching materials sciences, generate interest in the sciences, and reinforce concepts of materials science through hands-on learning techniques. We are now in the process of determining how to best involve teachers with the loan box program, and determine what materials they need to best utilise the program. If you have any further interest in viewing this program, or meeting with us in person please let us know and you will be admitted to The Tower as our visitor free of charge.

Please help us by taking a brief 5 minute survey at:
http://www.surveymonkey.com/s.aspx?sm=Bvxxo0_2fYT6SiCwGT6bDqTA_3d_3d

Kind Regards,

Royal Armouries
HM Tower of London EC3N 4AB
020 3166 6671
www.royalarmouries.org

Secondary School Mail Merge Follow-up Email

Dear <<name>>,

<<school>>

We understand you are very busy and/or may not have received this email previously, but would appreciate the input of a science teacher who may have 5 minutes to fill out the brief survey below.

The Royal Armouries at the Tower of London has recently put together two loan boxes. The loan box is an outreach program created to aid in teaching materials sciences, generate interest in the sciences, and reinforce concepts of materials science through hands-on learning techniques. We are now in the process of determining how to best involve teachers with the loan box program, and determine what materials they need to best utilise the program. If you have any further interest in viewing this program, or meeting with us in person please let us know and you will be admitted to The Tower as our visitor free of charge.

Please help us by taking a brief 5 minute survey at:
http://www.surveymonkey.com/s.aspx?sm=Bvxxo0_2fYT6SiCwGT6bDqTA_3d_3d

Kind Regards,

Royal Armouries
HM Tower of London EC3N 4AB
020 3166 6671
www.royalarmouries.org

Appendix E: Standardized Question Response Email

Thank you for your interest in the loan box program. The Royal Armouries at HM Tower of London currently has two loan boxes, a polymer box and a metals box. The loan boxes were designed to compliment a QCA based curriculum.

The polymer box is focused on key stage 3, but can also be used in key stage 4. Included in the box is a series of six experiments, a teaching manual, and PowerPoint presentation about polymers and there uses in body protection. For key stage 3 some of the concepts covered include atoms and elements (Unit 8E), forces and effects (7K), simple chemical reactions (7F), compounds and mixtures (8F), and using chemistry (9H). Due to the number of requirements key stage 4 must be compliant with, we would be more then happy to discuss this with you on a more personal level. The polymers box is small and light enough to allow for easy transportation. Also, an education officer can accompany the box to do a past to present armour handling session looking at materials and their properties to help support the polymer box.

The metals box is intended to help transition from key stage 2 to key stage 3, targeting 6th and 7th year students. Included in the box is a Teaching pack, an Intro Pack, and a Reactivity Series Pack. The experiments touch on pieces of all three concepts in the key stage 3 curriculum classifying materials, changing materials, and patterns of behaviour which contains a section solely on metals (Unit 3A, 3B, and 3C). The metals box is a little larger and heavier and would need to be couriered to your school. Again an education officer can visit your school for an armour handling session.

If you have any further questions please contact amy.preece@amouries.org.uk or call us at 020 3166 6671. If you have interest in viewing this program, or meeting with us in person please let us know and you will be admitted to the Tower as our visitor free of charge.

Kind Regards,

Royal Armouries
HM Tower of London EC3N 4AB
020 3166 6671
www.royalarmouries.org

Appendix F: Secondary School Raw Survey Results

Royal Armouries at HM Tower of London

1. What's you gender?

		Response Percent	Response Count
Male		38.8%	31
Female		**61.3%**	49
	answered question		**80**
	skipped question		**0**

2. What county [borough] do you teach in?

		Response Count
		74
	answered question	**74**
	skipped question	**6**

3. What is your age?

		Response Percent	Response Count
20-35		**38.0%**	30
35-50		**38.0%**	30
50-65		22.8%	18
65+		1.3%	1
	answered question		**79**
	skipped question		**1**

7. Please rank which forms of contact you are more likely to respond to:

	1(least likely)	2	3	4	5 (most likely)	Rating Average	Response Count
Mailings	**31.0% (18)**	29.3% (17)	24.1% (14)	8.6% (5)	6.9% (4)	2.31	58
Email	2.8% (2)	1.4% (1)	6.9% (5)	19.4% (14)	**69.4% (50)**	4.51	72
Websites	8.5% (5)	25.4% (15)	25.4% (15)	**39.0% (23)**	1.7% (1)	3.00	59
Direct, personal phone calls	**33.8% (22)**	13.8% (9)	23.1% (15)	20.0% (13)	9.2% (6)	2.57	65
Newsletters	25.0% (17)	**32.4% (22)**	25.0% (17)	10.3% (7)	7.4% (5)	2.43	68
						Other	1
						answered question	**80**
						skipped question	**0**

8. Have you utilised any outreach programmes or outreach materials in your curriculum before?

	Response Percent	Response Count
Yes	31.2%	24
No	**68.8%**	53
	answered question	**77**
	skipped question	**3**

9. When would you need to know about the loan box programme to successfully plan a programme in your classroom?

	Response Percent	Response Count
2 weeks before	7.5%	6
4 weeks before	12.5%	10
6 weeks before	27.5%	22
8 weeks before	**30.0%**	24
Other (please specify)	22.5%	18
answered question		**80**
skipped question		**0**

10. Would school incentives increase your interest in the programme?

	Response Percent	Response Count
Yes	**84.4%**	65
No	15.6%	12
answered question		**77**
skipped question		**3**

11. Would your school be able to cover transportation costs for the loan box?

	Response Percent	Response Count
Yes	45.3%	34
No	**54.7%**	41
answered question		**75**
skipped question		**5**

12. Would you use the loan box programme (Key Stage 2, Key Stage 3)?

	Response Percent	Response Count
Yes	**92.3%**	72
No	7.7%	6
answered question		**78**
skipped question		**2**

13. How would you use the loan box programme?

	Response Percent	Response Count
In lieu of a visit to the museum	**53.2%**	41
Before a visit to the museum	11.7%	9
After a visit to the museum	6.5%	5
Before and after a visit to the museum	28.6%	22
answered question		**77**
skipped question		**3**

14. Would you prefer someone to accompany the loan box to aid in teaching it for a day?

	Response Percent	Response Count
Yes	**75.6%**	59
No	24.4%	19
answered question		**78**
skipped question		**2**

15. What supplements would you like to see with an outreach programme (such as a website, teaching manual, homework, PowerPoint presentation, etc.)?		
		Response Count
		68
	answered question	**68**
	skipped question	**12**

16. How would you like to see the Royal Armouries become more involved with you and your school?		
		Response Count
		39
	answered question	**39**
	skipped question	**41**

17. Additional comments or questions?		
		Response Count
		9
	answered question	**9**
	skipped question	**71**

18. If you would like to be contacted regarding the outreach programme, please provide contact details below:

	Response Percent	Response Count
Name:	**100.0%**	61
School:	**100.0%**	61
Address:	95.1%	58
Address 2:	88.5%	54
County/Borough	93.4%	57
Postal Code:	93.4%	57
Email Address:	93.4%	57
Phone Number:	72.1%	44
	answered question	**61**
	skipped question	**19**

6.1.1.1 Secondary Teacher Survey – Question 2 Delineated

	Comment Text	Response Date
1.	kent	Thu, 6/5/08 2:57 PM
2.	North Yorkshire	Wed, 6/4/08 10:07 AM
3.	derbyshire	Tue, 6/3/08 11:50 PM
4.	DEvon	Tue, 6/3/08 12:50 PM
5.	Brent	Tue, 6/3/08 12:17 PM
6.	Souith Yorkshire	Tue, 6/3/08 11:17 AM
7.	Dorset	Tue, 6/3/08 10:41 AM
8.	sheffield	Tue, 6/3/08 9:45 AM
9.	Lincolnshire	Tue, 6/3/08 9:26 AM
10.	Suffolk	Mon, 6/2/08 6:39 PM
11.	barking and dagenham	Mon, 6/2/08 5:02 PM
12.	BANES	Mon, 6/2/08 3:30 PM
13.	OXFORDSHIRE	Mon, 6/2/08 3:00 PM
14.	devon	Mon, 6/2/08 2:12 PM
15.	East riding of yorkshire	Mon, 6/2/08 2:04 PM
16.	yorkshire	Mon, 6/2/08 1:24 PM
17.	Manchester	Mon, 6/2/08 1:07 PM
18.	Oxon	Mon, 6/2/08 12:59 PM
19.	Cumbria	Mon, 6/2/08 12:28 PM
20.	Crawley, West Sussex	Mon, 6/2/08 12:25 PM
21.	Hampshire	Mon, 6/2/08 12:23 PM
22.	Calderdale	Mon, 6/2/08 12:18 PM
23.	Yorkshire	Mon, 6/2/08 12:16 PM
24.	Wandsworth	Mon, 6/2/08 11:43 AM
25.	IoW	Mon, 6/2/08 11:21 AM
26.	Royal Borough of Windsor and Maidenhead	Mon, 6/2/08 11:12 AM
27.	northumberland	Mon, 6/2/08 11:02 AM
28.	Devon	Mon, 6/2/08 9:55 AM
29.	Surrey	Mon, 6/2/08 9:55 AM
30.	Suffolk	Mon, 6/2/08 9:45 AM
31.	kent	Mon, 6/2/08 9:22 AM
32.	Gloucetershire	Mon, 6/2/08 9:04 AM
33.	Suffolk	Mon, 6/2/08 8:56 AM
34.	West Midlands	Sun, 6/1/08 4:18 PM
35.	cheshire	Sat, 5/31/08 9:47 AM
36.	North Yorkshire	Fri, 5/30/08 11:55 AM
37.	Leicestershire	Mon, 5/26/08 10:45 AM
38.	Lambeth	Fri, 5/23/08 9:15 AM
39.	Suffolk	Thu, 5/22/08 4:45 PM
40.	Kent	Thu, 5/22/08 4:11 PM
41.	Tyne and Wear	Thu, 5/22/08 1:25 PM
42.	Tonbridge. Kent	Wed, 5/21/08 4:46 PM
43.	derbyshire	Wed, 5/21/08 4:33 PM
44.	Kent	Wed, 5/21/08 2:00 PM
45.	North east lincolnshire	Wed, 5/21/08 10:35 AM
46.	essex	Wed, 5/21/08 9:45 AM
47.	south gloucestershire	Tue, 5/20/08 9:13 PM
48.	Derbyshire	Tue, 5/20/08 5:44 PM

49.	kent	Tue, 5/20/08 4:50 PM
50.	newcaslte upon tyne	Tue, 5/20/08 4:29 PM
51.	Suffolk	Tue, 5/20/08 3:15 PM
52.	south yorkshire	Tue, 5/20/08 12:51 PM
53.	Warrington	Tue, 5/20/08 11:50 AM
54.	Glos	Tue, 5/20/08 11:43 AM
55.	west sussex	Tue, 5/20/08 11:04 AM
56.	Suffolk	Tue, 5/20/08 10:48 AM
57.	Lincs	Tue, 5/20/08 10:38 AM
58.	Leicestershire	Tue, 5/20/08 10:35 AM
59.	West Sussex	Tue, 5/20/08 9:50 AM
60.	kent	Tue, 5/20/08 9:03 AM
61.	isle of man	Tue, 5/20/08 8:35 AM
62.	Cumbria	Tue, 5/20/08 8:24 AM
63.	northants	Tue, 5/20/08 8:11 AM
64.	east sussex	Tue, 5/20/08 8:01 AM
65.	england	Mon, 5/19/08 9:43 PM
66.	oxfordshire	Mon, 5/19/08 8:19 PM
67.	Gloucestershire	Mon, 5/19/08 8:09 PM
68.	Rother, East Sussex	Mon, 5/19/08 5:43 PM
69.	ches	Mon, 5/19/08 5:21 PM
70.	surrey	Mon, 5/19/08 4:23 PM
71.	Hounslow	Mon, 5/19/08 4:11 PM
72.	birmingham	Mon, 5/19/08 4:03 PM
73.	barnet	Mon, 5/19/08 3:57 PM
74.	Plymouth, Devon	Mon, 5/19/08 3:46 PM

6.1.1.2 Secondary Teacher Survey – Question 4 Delineated

	Comment Text	Response Date
1.	28	Thu, 6/5/08 2:57 PM
2.	25	Wed, 6/4/08 10:07 AM
3.	30	Tue, 6/3/08 11:50 PM
4.	30	Tue, 6/3/08 12:50 PM
5.	26	Tue, 6/3/08 12:17 PM
6.	25	Tue, 6/3/08 11:17 AM
7.	28	Tue, 6/3/08 10:41 AM
8.	25	Tue, 6/3/08 9:45 AM
9.	25	Tue, 6/3/08 9:26 AM
10.	29	Mon, 6/2/08 6:39 PM
11.	25	Mon, 6/2/08 5:02 PM
12.	25	Mon, 6/2/08 3:30 PM
13.	24	Mon, 6/2/08 3:00 PM
14.	30	Mon, 6/2/08 2:12 PM
15.	28	Mon, 6/2/08 2:04 PM
16.	24	Mon, 6/2/08 1:24 PM
17.	30	Mon, 6/2/08 1:07 PM
18.	25-30	Mon, 6/2/08 12:59 PM
19.	26	Mon, 6/2/08 12:28 PM
20.	28	Mon, 6/2/08 12:25 PM
21.	25	Mon, 6/2/08 12:23 PM
22.	25	Mon, 6/2/08 12:18 PM
23.	27	Mon, 6/2/08 12:16 PM
24.	25	Mon, 6/2/08 11:43 AM
25.	27	Mon, 6/2/08 11:21 AM
26.	25	Mon, 6/2/08 11:12 AM
27.	30	Mon, 6/2/08 11:02 AM
28.	30	Mon, 6/2/08 10:04 AM
29.	28	Mon, 6/2/08 9:55 AM
30.	30	Mon, 6/2/08 9:55 AM
31.	27	Mon, 6/2/08 9:45 AM
32.	30	Mon, 6/2/08 9:22 AM
33.	26	Mon, 6/2/08 9:04 AM
34.	22	Mon, 6/2/08 8:56 AM
35.	30	Sun, 6/1/08 4:18 PM
36.	28	Sat, 5/31/08 9:47 AM
37.	24	Fri, 5/30/08 11:55 AM
38.	12	Mon, 5/26/08 10:45 AM
39.	28	Fri, 5/23/08 9:15 AM
40.	28	Thu, 5/22/08 4:45 PM
41.	32	Thu, 5/22/08 4:11 PM
42.	26	Thu, 5/22/08 1:25 PM
43.	32 at KS3 24 at KS4 15 at KS5	Wed, 5/21/08 4:46 PM
44.	25	Wed, 5/21/08 4:33 PM
45.	25	Wed, 5/21/08 2:00 PM
46.	30	Wed, 5/21/08 10:35 AM
47.	30	Wed, 5/21/08 9:45 AM
48.	30	Wed, 5/21/08 8:15 AM
49.	22	Tue, 5/20/08 9:13 PM
50.	30	Tue, 5/20/08 5:44 PM

51.	26	Tue, 5/20/08 4:50 PM
52.	30	Tue, 5/20/08 4:29 PM
53.	26	Tue, 5/20/08 3:44 PM
54.	28	Tue, 5/20/08 3:15 PM
55.	30	Tue, 5/20/08 12:51 PM
56.	30	Tue, 5/20/08 11:50 AM
57.	28	Tue, 5/20/08 11:43 AM
58.	28	Tue, 5/20/08 11:04 AM
59.	28	Tue, 5/20/08 10:48 AM
60.	28	Tue, 5/20/08 10:38 AM
61.	30	Tue, 5/20/08 10:35 AM
62.	23	Tue, 5/20/08 10:25 AM
63.	25	Tue, 5/20/08 10:06 AM
64.	28	Tue, 5/20/08 9:50 AM
65.	30	Tue, 5/20/08 9:12 AM
66.	30	Tue, 5/20/08 9:03 AM
67.	25	Tue, 5/20/08 8:35 AM
68.	26	Tue, 5/20/08 8:24 AM
69.	30	Tue, 5/20/08 8:11 AM
70.	28	Tue, 5/20/08 8:01 AM
71.	30	Mon, 5/19/08 9:43 PM
72.	28	Mon, 5/19/08 8:19 PM
73.	25	Mon, 5/19/08 8:09 PM
74.	30	Mon, 5/19/08 5:43 PM
75.	28	Mon, 5/19/08 5:21 PM
76.	30	Mon, 5/19/08 4:23 PM

77.	24	Mon, 5/19/08 4:11 PM
78.	28	Mon, 5/19/08 4:03 PM
79.	27	Mon, 5/19/08 3:57 PM
80.	28	Mon, 5/19/08 3:46 PM

6.1.1.3 Secondary Teacher Survey – Question 5 Delineated

	Comment Text	Response Date
1.	ks4	Thu, 6/5/08 2:57 PM
2.	KS3-KS4	Wed, 6/4/08 10:07 AM
3.	3 and 4	Tue, 6/3/08 11:50 PM
4.	4	Tue, 6/3/08 12:50 PM
5.	KS3- KS4	Tue, 6/3/08 12:17 PM
6.	3 & 4	Tue, 6/3/08 11:17 AM
7.	3-5	Tue, 6/3/08 10:41 AM
8.	5	Tue, 6/3/08 9:45 AM
9.	KS4	Tue, 6/3/08 9:26 AM
10.	Ks4	Mon, 6/2/08 6:39 PM
11.	ks4	Mon, 6/2/08 5:02 PM
12.	KS 3 and 4	Mon, 6/2/08 3:30 PM
13.	SECONDARY	Mon, 6/2/08 3:00 PM
14.	4 and 5	Mon, 6/2/08 2:12 PM
15.	4	Mon, 6/2/08 2:04 PM
16.	3 and 4	Mon, 6/2/08 1:24 PM
17.	4	Mon, 6/2/08 1:07 PM
18.	Key Stage 3 and 4	Mon, 6/2/08 12:59 PM
19.	4	Mon, 6/2/08 12:28 PM
20.	KS4	Mon, 6/2/08 12:25 PM
21.	3 and 4	Mon, 6/2/08 12:23 PM
22.	KS3&4	Mon, 6/2/08 12:18 PM
23.	KS3, KS4 and A-level	Mon, 6/2/08 12:16 PM
24.	KS4	Mon, 6/2/08 11:43 AM
25.	ks4	Mon, 6/2/08 11:21 AM
26.	4 and 5	Mon, 6/2/08 11:12 AM
27.	KS4	Mon, 6/2/08 11:02 AM
28.	KS4	Mon, 6/2/08 10:04 AM
29.	KS3	Mon, 6/2/08 9:55 AM
30.	3 and 4	Mon, 6/2/08 9:55 AM
31.	3 and 4	Mon, 6/2/08 9:45 AM
32.	4	Mon, 6/2/08 9:22 AM
33.	4	Mon, 6/2/08 8:56 AM
34.	ks3 and ks4	Sun, 6/1/08 4:18 PM
35.	4,5	Sat, 5/31/08 9:47 AM
36.	KS4	Fri, 5/30/08 11:55 AM
37.	4	Mon, 5/26/08 10:45 AM
38.	Key Stage 3, 4 and 5	Fri, 5/23/08 9:15 AM
39.	3-5	Thu, 5/22/08 4:45 PM
40.	3-5	Thu, 5/22/08 4:11 PM
41.	KS3 and KS4	Thu, 5/22/08 1:25 PM
42.	KS3,4 and 5	Wed, 5/21/08 4:46 PM
43.	3&4	Wed, 5/21/08 4:33 PM
44.	3/4	Wed, 5/21/08 2:00 PM
45.	KS3/4	Wed, 5/21/08 10:35 AM
46.	KS3,4,5	Wed, 5/21/08 9:45 AM
47.	ks4	Wed, 5/21/08 8:15 AM
48.	Ks4	Tue, 5/20/08 9:13 PM
49.	4	Tue, 5/20/08 5:44 PM
50.	KS 3 and KS5	Tue, 5/20/08 4:50 PM
51.	4/5	Tue, 5/20/08 4:29 PM
52.	3 & 4	Tue, 5/20/08 3:44 PM

53.	3	Tue, 5/20/08 3:15 PM
54.	3 / 4	Tue, 5/20/08 12:51 PM
55.	KS4 & 5	Tue, 5/20/08 11:50 AM
56.	4	Tue, 5/20/08 11:43 AM
57.	ks3 and 4	Tue, 5/20/08 11:04 AM
58.	4	Tue, 5/20/08 10:48 AM
59.	3&4	Tue, 5/20/08 10:38 AM
60.	3	Tue, 5/20/08 10:35 AM
61.	3 and 4	Tue, 5/20/08 10:25 AM
62.	KS3 and KS4	Tue, 5/20/08 10:06 AM
63.	3 and 4	Tue, 5/20/08 9:50 AM
64.	ks4 and 5	Tue, 5/20/08 9:12 AM
65.	3, 4 and 5	Tue, 5/20/08 9:03 AM
66.	3-4-5	Tue, 5/20/08 8:35 AM
67.	KS3 and 4	Tue, 5/20/08 8:24 AM
68.	ks4	Tue, 5/20/08 8:11 AM
69.	3 and 4	Tue, 5/20/08 8:01 AM
70.	4	Mon, 5/19/08 9:43 PM
71.	3 & 4	Mon, 5/19/08 8:19 PM
72.	KS3 & KS4	Mon, 5/19/08 8:09 PM
73.	3 and 4	Mon, 5/19/08 5:43 PM
74.	KS3, 4 and 5	Mon, 5/19/08 5:21 PM
75.	4	Mon, 5/19/08 4:23 PM
76.	all	Mon, 5/19/08 4:11 PM
77.	4 and 5	Mon, 5/19/08 4:03 PM
78.	4 and 5	Mon, 5/19/08 3:57 PM
79.	4	Mon, 5/19/08 3:46 PM

6.1.1.4 Secondary Teacher Survey – Question 15 Delineated

	Comment Text	Response Date
1.	website, powerpoint	Thu, 6/5/08 2:57 PM
2.	teaching manual and powerpoint presentations	Wed, 6/4/08 10:07 AM
3.	presentations and worksheets with NC links	Tue, 6/3/08 11:50 PM
4.	all of the above	Tue, 6/3/08 12:17 PM
5.	teaching manual PowwrPoint videos	Tue, 6/3/08 10:41 AM
6.	website curriculum referenced support materials	Tue, 6/3/08 9:45 AM
7.	PPT and teaching manual	Tue, 6/3/08 9:26 AM
8.	The above stated resources would be ideal	Mon, 6/2/08 6:39 PM
9.	power point website	Mon, 6/2/08 5:02 PM
10.	powwer point,teaching manual	Mon, 6/2/08 3:30 PM
11.	Lesson plans with homework ideas Website/Powerpoint DVD	Mon, 6/2/08 3:00 PM
12.	website, teaching materials, powerpoint presentation, pupils notes	Mon, 6/2/08 2:04 PM
13.	Teaching resources	Mon, 6/2/08 1:07 PM
14.	Internet based resources to support independent learning	Mon, 6/2/08 12:59 PM
15.	homeworks / web links / cross curricular links	Mon, 6/2/08 12:28 PM
16.	teaching manual/guide	Mon, 6/2/08 12:25 PM
17.	PowerPoint presentations would be useful as would prior guidance on lessons that can be carried out using the resources - we would need to know that it fits in with the work we are doing.	Mon, 6/2/08 12:23 PM
18.	WEb site ppp teaching manual	Mon, 6/2/08 12:18 PM
19.	powerPoint presentaion plus homework	Mon, 6/2/08 11:43 AM
20.	Any of the above	Mon, 6/2/08 11:12 AM
21.	Any presentation materials	Mon, 6/2/08 10:04 AM
22.	Homework suggestions, proposed lesson plans, websites for students to access	Mon, 6/2/08 9:55 AM
23.	Whiteboard resources and homework resources	Mon, 6/2/08 9:55 AM
24.	All of the above	Mon, 6/2/08 9:45 AM

25.	power point, interactive games	Mon, 6/2/08 9:22 AM
26.	All of the above! Advance information as to the contents would be usefull	Mon, 6/2/08 9:04 AM
27.	manual, hwk, ppt	Sun, 6/1/08 4:18 PM
28.	independent activities	Sat, 5/31/08 9:47 AM
29.	teaching manual, powerpoint would be nice	Mon, 5/26/08 10:45 AM
30.	Teaching Manual, Power point presentation, website	Fri, 5/23/08 9:15 AM
31.	PowerPoint presentation	Thu, 5/22/08 4:45 PM
32.	website, teaching manual (electronic), PowerPoint would all be useful	Thu, 5/22/08 4:11 PM
33.	powerpoint presentation would be useful for students but a website with the resources and how to use them would be fine for staff. Homework would also be useful	Thu, 5/22/08 1:25 PM
34.	website teaching manual	Wed, 5/21/08 4:46 PM
35.	power point, teaching manual	Wed, 5/21/08 4:33 PM
36.	Links to a website / powerpoint presentation as the school is fuly interactive and online.	Wed, 5/21/08 2:00 PM
37.	tyeaching manual or ideas, powerpoint	Wed, 5/21/08 10:35 AM
38.	website including power point, interactive activitieis for teacher. Not pupils as may not have individual computer access	Wed, 5/21/08 9:45 AM
39.	powerpoint	Wed, 5/21/08 8:15 AM
40.	power point, teaching plans, printable resources, differentiated resources	Tue, 5/20/08 9:13 PM
41.	- Resources such as PowerPoints to aid the delivery and to assist own general knowledge.	Tue, 5/20/08 5:44 PM
42.	All of the above would be of interest.	Tue, 5/20/08 4:50 PM
43.	materials geared to the particular syallabus i am following. A lot of materials produced are not relevant enough to be used under the time constraints we have at KS4 and 5	Tue, 5/20/08 4:29 PM
44.	website, teaching manual, homework, PowerPoint presentation as much as possible	Tue, 5/20/08 3:44 PM
45.	teaching Scheme/suggestions	Tue, 5/20/08 3:15 PM
46.	powerPoint	Tue, 5/20/08 12:51 PM

47.	teaching manual powerPoint presentations interactive websites that are both student and tutor friendly	Tue, 5/20/08 11:50 AM
48.	need more info	Tue, 5/20/08 11:43 AM
49.	website, teaching manual, homework, PowerPoint presentation	Tue, 5/20/08 11:04 AM
50.	Powerpoints/teaching manual/resources	Tue, 5/20/08 10:48 AM
51.	website plus all the others	Tue, 5/20/08 10:38 AM
52.	Powerpoints, suggested wordsheets/activities	Tue, 5/20/08 10:35 AM
53.	teaching manual and pupil materials	Tue, 5/20/08 10:06 AM
54.	Presentation, teaching manual/lesson plans worksheets whether for calss usee or h/wk	Tue, 5/20/08 9:50 AM
55.	website linked to student activities	Tue, 5/20/08 9:12 AM
56.	powerpoints and a teaching manual	Tue, 5/20/08 9:03 AM
57.	power points, websites	Tue, 5/20/08 8:35 AM
58.	All of the above would be useful	Tue, 5/20/08 8:24 AM
59.	power point, homework teaching manual	Tue, 5/20/08 8:01 AM
60.	any of the above	Mon, 5/19/08 8:19 PM
61.	website, teaching guide	Mon, 5/19/08 8:09 PM
62.	website, powerpoint, leaflets, sample lessons.	Mon, 5/19/08 5:43 PM
63.	website containing all other resources to pick our best approach	Mon, 5/19/08 5:21 PM
64.	all of the above	Mon, 5/19/08 4:23 PM
65.	Teacher plana and student worksheets/activities to support the loan box	Mon, 5/19/08 4:11 PM
66.	teaching guide and powerpoints would be useful	Mon, 5/19/08 4:03 PM
67.	wedsite for students at home, powerpoint presentations for class	Mon, 5/19/08 3:57 PM
68.	all of above + video clips/animations	Mon, 5/19/08 3:46 PM

6.1.1.5 Secondary Teacher Survey – Question 16 Delineated

	Comment Text	Response Date
1.	any links to the metals part of KS4 would be good	Tue, 6/3/08 11:50 PM
2.	see science at work in the real world- context based teaching	Tue, 6/3/08 12:17 PM
3.	Making resources accessible to schools outside London who find it too expensive in terms of money and time to visit	Tue, 6/3/08 10:41 AM
4.	Yes, we support any outside materials or contact that can help supplement and enrich the curriculum	Mon, 6/2/08 6:39 PM
5.	GCSE Applied Science Materials and properties	Mon, 6/2/08 5:02 PM
6.	Support with careers/work-related learning events.	Mon, 6/2/08 3:00 PM
7.	make the subject more relevant and interesting	Mon, 6/2/08 2:04 PM
8.	More visits to the Royal armouries Lecture talk by Armouries staff to our students - ideally at our school	Mon, 6/2/08 11:43 AM
9.	Personal visits	Mon, 6/2/08 11:12 AM
10.	As a resource providing an alternative way of looking at materials and the impact of chemical reactions!	Mon, 6/2/08 10:04 AM
11.	It would be nice to work with outside agencies and a good experience for our students to learn outside the classroom.	Mon, 6/2/08 9:55 AM
12.	I know very little currently so any involvement is a start. Careers - science at work so students see the relevance	Mon, 6/2/08 9:55 AM
13.	Need a greater awareness of what they do.	Mon, 6/2/08 9:45 AM
14.	Workshops with the armouries	Mon, 6/2/08 9:22 AM
15.	something to engage students and compliment the delivery of the syllabus	Sun, 6/1/08 4:18 PM
16.	links to maths and citizenship perhaps	Mon, 5/26/08 10:45 AM
17.	More closer links - e.g. Career Talks, School assemblies	Fri, 5/23/08 9:15 AM
18.	Offer visiting speakers or the chance to take groups of pupils there at substantially reduced prices.	Thu, 5/22/08 4:45 PM
19.	The new "How science works" aspect of science involves the use of science processes in all careers etc. It would be excellent for students to see how science can be used with history. As part of our science city intiative we ran a science / history cross curricular visit to the Thackray museum and Royal armouries in Leeds. I did not fully realise how much science we could have fitted in to the armouries visit and with your help may be able to make greater use of the day next year.	Thu, 5/22/08 1:25 PM

20.	To help us make students aware of science in the real world.	Wed, 5/21/08 2:00 PM
21.	discussions and shows, demonstrations.	Wed, 5/21/08 8:15 AM
22.	I am not sure	Tue, 5/20/08 9:13 PM
23.	Any involvement is always a bonus.	Tue, 5/20/08 5:44 PM
24.	provide oportunities to liven up science lessons	Tue, 5/20/08 3:44 PM
25.	With the army cadets	Tue, 5/20/08 3:15 PM
26.	don't know	Tue, 5/20/08 11:43 AM
27.	science of warfare 9 good tie in with humanities. We are currently looking to expand our cross curricular activities and this would be an interesting aspect	Tue, 5/20/08 11:04 AM
28.	Dont know	Tue, 5/20/08 10:48 AM
29.	not sure	Tue, 5/20/08 10:38 AM
30.	no sure what else they could offer	Tue, 5/20/08 10:06 AM
31.	via VTLE	Tue, 5/20/08 9:12 AM
32.	fact sheets keep us updated etc. Posters.	Tue, 5/20/08 8:35 AM
33.	I'm not sure	Tue, 5/20/08 8:24 AM
34.	video conferencing	Tue, 5/20/08 8:01 AM
35.	Visit to school as visit to museum could be difficult due to distance	Mon, 5/19/08 8:09 PM
36.	More involved with the students and the lessons.	Mon, 5/19/08 5:43 PM
37.	Visits to the school and local partner primary schools to show what goes on there and to showcase some of the materials	Mon, 5/19/08 4:11 PM
38.	Do not know what you have to offer	Mon, 5/19/08 3:57 PM
39.	supply material	Mon, 5/19/08 3:46 PM

6.1.1.6 Secondary Teacher Survey – Question 17 Delineated

	Comment Text	Response Date
1.	the transport costs of the box could be prohibitive within very tight budgets	Tue, 6/3/08 11:50 PM
2.	I would love to visit to see what you can offer our students	Mon, 6/2/08 5:02 PM
3.	I took my family to the Armouries.We didn't like it.	Fri, 5/30/08 11:55 AM
4.	I am not aware of the cost involved in transportation of the loan Box; Therefore I was not able to say yes to the relevant question - Q11. A member of our department is a former member of the British Army. He could be very helpful with this idea	Fri, 5/23/08 9:15 AM
5.	Answering these questions without prior knowledge of the loan box. ave no idea whzt is in it.	Wed, 5/21/08 9:45 AM
6.	Resources need to fit within our curriculum so that it addresses key points. It also needs to be engaging, interesting, challenging and inexpensive.	Tue, 5/20/08 9:13 PM
7.	i would like to work with somebody in the Armouries to identify where your loan box fits into the GCSE syllabuses and the new KS3 syllabus - this would help you identify where the loan box could be used.	Tue, 5/20/08 11:50 AM
8.	need more info	Tue, 5/20/08 11:43 AM
9.	Are there more details about the contente of the loan box, and what it can be used to deliver on a web site?	Tue, 5/20/08 8:24 AM

6.1.1.7 Secondary Teacher Survey – Question 18 – Teacher Contact Information – Delineated

Teacher	School	Road	Town	County
Lesley Moses	Hope Valley College	Castleton Road	Hope, hope Valley	Derbyshire
Evelyn Agyepong	JKBTC	crest Road	Neasden, London	Brent
Sarah Sims	Brinsworth Comp	Brinsworth Lane	Brinsworth	Rotherham
Mrs B Mustoe	The Purbeck School	Worgret Road	Wareham	Dorset
Mr. K. A. Longden	Middlefield School of Technology	Middlefield Lane	Gainsborough	Lincolnshire
Mark Considine	Bungay High School	Queens Road	Bungay	suffolk
simon charlton head of science	eastbrook school	dagenham road	dagenham	essex
AMANDA CARTER-FRASER	OXFORD COMMUNITY SCHOOL	GLANVILLE ROAD	COWLEY	OXFORD
Michael Connolly	South Holderness TC	Station road	Preston	East riding of yorkshire
Rachel Stone	St. Annes Academy	Hollin Lane	Middleton	
Sarah Naudi	Gillotts School	Gillotts Lane	Henley on Thames	Oxon
J.Hickey	Newman School	Lismore Place	Carlisle	Cumbria
Grant Taylor	Oriel High School	Maidenbower Lane	Maidenbower	Crawley
JO Clark	The Ridings School	Nursery LAne	Ovenden HAlifax	West Yorks
Chris Whale	Graveney School	Welham Road		wandsworth
A Clark	Matthew Arnold School	Arnolds Way	Oxford	Oxfordshire
Paul Ironmonger	Priory School	West Bank	Dorking	Surrey
Heidi Bishop	Stoke Damerel Community College	Somerset Place	Plymouth	Devon
Chris Herron	Hadleigh High School	High Lands Road	Hadleigh	Suffolk
Julie lindsay	Thomas aveling school	arethusa road	rochester	kent
Sukhdev Bhatoey	Washwood Heath Technology College	Burney Lane	Birmingham	West Midlands
Margaret Wild	Hind Leys College	Forest Street	Shepshed	Leics
Patrick Hingston	Archbishop Tenisions	55 Kennington Oval	London	Lambeth
Dr. Nick Flores	Kesgrave High School	Main Road, Kesgrave	Ipswich	Suffolk
Michael Leake	Queen Elizabeth's Grammar School	Abbey Place	Faversham	KENT
julie bradley	Walker Technology College	middle street	Newcastle upon tyne	Tyne and Wear
Catherine Parmley	The Judd School	Brook Street	Tonbridge	Kent
Mary Ann Clark	Parkside School	Boythorp Avenue	Chesterfield	Derbyshire
Mrs V Ross	The North School	Essella Road	Ashford	Kent
C. Hewitt	The King John School			
Mr. P. Adamson	Mangotsfield School	Rodway Hill	Mangotsfield	Bristol
Jo Hulse	The Long Eaton school	Thoresby Road	Long Eaton	Nottingham
Dr. B. A. Cussans	Simon Langton Girls' Grammar School	Old Dover Road	Canterbury	Kent

Teacher	School	Road	Town	County
Marion Gallon	Walbottle Campus			
tim brown	city academy bristol	russel town ave	st george	bristol
Ms Tracylyn Stinson	Mildenhall College of Technolgy	Bury Road	Bury St Edmunds	Suffolk
John Bedford	Westfield Sports College	Eckington Road	Sothall	Sheffield
ann plumpton	penketh high school	heath road	penketh	warrington
Jonathan Scott	Severn Vale School	School Lane	Quedgeley	Gloucs
jim nicholls	holy trinity school	buckswood drive	gossops green	west sussex
Jackie Smith	Mildenhall College of Technology	Bury Rd	Mildenhall	Suffolk
Peter Wood	Caistor Yarborough School	Grimsby Road	Caistor	Lincs
Mark Stokes	Manor High School	Copse Close	Oadby	Leicestershire
Dr Ian Saunders	The Priory Witham Accademy	Shannon Avenue	Lincoln	Lincolnshire
Mrs K Mistry	Kaskenmoor	Roman Road	Hollinwood	Oldham
Mrs Emma Rimmer	Oathall Community College	Appledore Gardens	Haywards Heath	West Sussex
Nicola	Mason	Nether Stowe High School	St Chads Road Lichfield	Staffs
nicola mitchell	Oakwood Park Grammar School	Oakwood Park	Maidstone	Kent
Will Ward	Ramsey Grammar School	lezayre Road	Ramsey	isle of man
p duffield	Parkview school	west avenue	Barrow in Furness	Cumbria
elaine gordon	grove college	darwell close		St leonars-on-sea
Miss laura aldridge	stoke damerel cc	somerset place		plymouth
Mrs L S Ellard	The Cooper School	Churchill Road	Bicester	Oxon
Kate Prinsep	Sir Thomas Rich's School	Oakleaze	Longlevens	Gloucester
Yee Lau	Bexhill High School	Down Road	Bexhill on Sea	East Sussex
margaret jordan	macclesfield high sch	park lane	macclesfield	ches
neil drury	king edward vi five ways	scotland lane	bartley green	birmingham
Jon Bradford	Mill Hill County High School	Worcester Crescent	Mill Hill	London
Andy Pugh	Ridgeway School	Moorland Road	Plymouth	Devon

Teacher	Postcode	Email	Phone Number
Lesley Moses	S33 6SD	lmoses@hopevalley.derbyshire.sch.uk	1433620555
Evelyn Agyepong	Nw27SN	evelyn.agyepong@jktc.brent.sch.uk	2084528700
Sarah Sims	S60 5EJ	bcssims.sarah@rgfl.org	01709 828383
Mrs B Mustoe	BH20 4PF	bmustoe@purbeck.dorset.sch.uk	01929 556301
Mr. K. A. Longden	DN21 1PU	kenneth.longden@middlefield.lincs.sch.uk	1427615199
Mark Considine	NR35 1RW	mconsidine@sciencecollege.net	01986 892140
simon charlton head of science	rm10 7ur	simoncharlton60@yahoo.co.uk	7867766459
AMANDA CARTER-FRASER	OX4 2AU	AMANDAF@OXFORD.OXON.SCH.UK	01865 427263
Michael Connolly	HU128UZ	connollym@ahtc.org.uk	
Rachel Stone	M24 6XA	sarstone@stannesacademy.org.uk	1616432643
Sarah Naudi	RG9 1PS	svn7726@gillotts.oxon.sch.uk	
J.Hickey	CA1 1NA	office@newman.cumbria.sch.uk	1228607470
Grant Taylor	RH10 7XW	gtaylor@oriel.w-sussex.sch.uk	
JO Clark	HX25SX	joclark@theridingsschool.co.uk	01422 351836
Chris Whale	SW17 9BU	cwhale@graveney.wandsworth.sch.uk	0208 680 7060
A Clark	OX2 9JE	aclark@matthew-arnold.oxon.sch.uk	01865 862232
Paul Ironmonger	RH4 3DG	pironmonger@staff.priorycofe.surrey.sch.uk	01306 887337
Heidi Bishop	PL3 4DN		
Chris Herron	IP7 5SR	chrisherron@tesco.net	1473823496
Julie lindsay	me1 2uw	jlindsay:thomasaveling.co.uk	
Sukhdev Bhatoey	B8 2AS	sba@washwoodheath.bham.sch.uk	0121 675 7272
Margaret Wild	LE12 9DB	office@hind-leys.leics.sch.uk	01509 504511
Patrick Hingston	SE11 5SR	school@ats.lambeth.sch.uk	0207735 3771
Dr. Nick Flores	IP5 2PB	nflores@kesgrave.suffolk.sch.uk	01473-624855
Michael Leake	ME17 7BQ	mjl@queenelizabeths.kent.sch.uk	01795 533132
julie bradley	NE6 4BY	julie.bradley@walker.newcastle.sch.uk	1912620911
Catherine Parmley	TN9 2PN	catherine.parmley@judd.kent.sch.uk	01732 358347
Mary Ann Clark	S40 2NS		
Mrs V Ross	TN235UW	vross@north.kent.sch.uk	1233614600
C. Hewitt		christineh(at)tkjs.demon.co.uk	
Mr. P. Adamson	BS16 9LH	pa@mangotsfieldschool.org.uk	01454 862700
Jo Hulse	NG10 3NP	jhulse@longeaton.derbyshire.sch.uk	
Dr. B. A. Cussans	CT1 3EW	bcussans@langton.kent.sch.uk	

Teacher	Postcode	Email	Phone Number
Marion Gallon		marion.gallon@walbottlecampus.newcaslte.sch.uk	
tim brown	bs59jh	brownt@cityacademy.bristol.sch.uk	
Ms Tracylyn Stinson	IP287HT	tracylyn.stinson@mct.suffolk.sch.uk	01638 714645
John Bedford	S20 1HQ	jbedford@westfield-admin.co.uk	1142485221
ann plumpton	wa5 2by	ann.plumpton1@btopenworld.com	01925722298 ext 215
Jonathan Scott	GL2 4PR	jscott@severnvale.gloucs.sch.uk	
jim nicholls	rh11 8je	jnicholls@wsgfl.org.uk	01292 423690
Jackie Smith	IP28 8HT	jackie.smith@mct.suffolk.sch.uk	01638 714645
Peter Wood	LN7 6QZ	peter.wood@caistor-yarborough.lincs.sch.uk	01472 851383
Mark Stokes	LE2 4FU	mstokes@manorhigh.leics.sch.uk	0116 271 4941
Dr Ian Saunders	LN6 7JG	isaunders@jrustontc.net	01522 882900
Mrs K Mistry	OL8 3PT	k.mistry@kaskenmoor.oldham.sch.uk	0161 618 4116
Mrs Emma Rimmer	RH16 2AQ	erimmer@wsgfl.org.uk	1444414001
Nicola	WS13 7NB	nmason@netherstowe.staffs.sch.uk	01543 263446 ext 222
nicola mitchell	ME16 8AH	nmitchell@oakwoodpark.kent.sch.uk	01622 726683
Will Ward	im8 2rg	w.ward@rgs.sch.im	1624811100
p duffield	LA13 9AY	pduffield@parkview.cumbria.sch.uk	01229 894661
elaine gordon	TN389JP	elaineg@grove.e-sussex.sch.uk	1424431691
Miss laura aldridge	pl3 4bd	laldridge@sdcc.plymouth.sch.uk	01752 556065
Mrs L S Ellard	OX26 4RS	lse2237@cooper.oxon.sch.uk	01869 242121
Kate Prinsep	GL2 0LF	kjp@strs.org.uk	
Yee Lau	TN39 4HT		
margaret jordan	sk11 8jr	Margaret.jordan@macchigh.cheshire.sch.uk	1625383100
neil drury	b32 4bt	ndrury@ke5ways.bham.sch.uk	
Jon Bradford	NW7 4LL	st100@mhchs.org.uk	
Andy Pugh	PL7 2RS	andy.pugh@ridgeway.plymouth.sch.uk	01752 337383

Appendix G: Primary School Raw Survey Results

Royal Armouries at Tower of London

1. What's you gender?

	Response Percent	Response Count
Male	27.8%	5
Female	**72.2%**	13
answered question		**18**
skipped question		**0**

2. What county [borough] do you teach in?

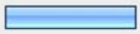
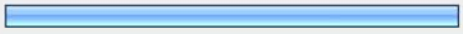
	Response Count
	18
answered question	**18**
skipped question	**0**

3. What is your age?

	Response Percent	Response Count
20-35	11.1%	2
35-50	**61.1%**	11
50-65	27.8%	5
65+	0.0%	0
answered question		**18**
skipped question		**0**

4. On average how many students are in your classes?		
		Response Count
		18
	answered question	**18**
	skipped question	**0**

5. What key stage do you primarily teach?		
		Response Count
		18
	answered question	**18**
	skipped question	**0**

6. Have you visited the Tower previously with your students?			
		Response Percent	Response Count
Yes		22.2%	4
No		**77.8%**	14
	answered question		**18**
	skipped question		**0**

7. Please rank which forms of contact you are more likely to respond to:

	1(least likely)	2	3	4	5 (most likely)	Rating Average	Response Count
Mailings	20.0% (2)	20.0% (2)	20.0% (2)	**40.0% (4)**	0.0% (0)	2.80	10
Email	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	**100.0% (10)**	5.00	10
Websites	9.1% (1)	9.1% (1)	**36.4% (4)**	27.3% (3)	18.2% (2)	3.36	11
Direct, personal phone calls	**27.3% (3)**	**27.3% (3)**	18.2% (2)	**27.3% (3)**	0.0% (0)	2.45	11
Newsletters	**30.8% (4)**	23.1% (3)	**30.8% (4)**	0.0% (0)	15.4% (2)	2.46	13
						Other	1
						answered question	**18**
						skipped question	**0**

8. Have you utilised any outreach programmes or outreach materials in your curriculum before?

	Response Percent	Response Count
Yes	11.8%	2
No	**88.2%**	15
	answered question	**17**
	skipped question	**1**

9. When would you need to know about the loan box programme to successfully plan a programme in your classroom?			
		Response Percent	Response Count
2 weeks before		0.0%	0
4 weeks before		0.0%	0
6 weeks before		33.3%	6
8 weeks before		**44.4%**	8
Other (please specify)		22.2%	4
	answered question		**18**
	skipped question		**0**

10. Would school incentives increase your interest in the programme?			
		Response Percent	Response Count
Yes		**61.1%**	11
No		38.9%	7
	answered question		**18**
	skipped question		**0**

11. Would your school be able to cover transportation costs for the loan box?			
		Response Percent	Response Count
Yes		22.2%	4
No		**77.8%**	14
	answered question		**18**
	skipped question		**0**

12. Would you use the loan box programme (Key Stage 2, Key Stage 3)?

	Response Percent	Response Count
Yes	**83.3%**	15
No	16.7%	3
answered question		**18**
skipped question		**0**

13. How would you use the loan box programme?

	Response Percent	Response Count
In lieu of a visit to the museum	**56.3%**	9
Before a visit to the museum	6.3%	1
After a visit to the museum	0.0%	0
Before and after a visit to the museum	37.5%	6
answered question		**16**
skipped question		**2**

14. Would you prefer someone to accompany the loan box to aid in teaching it for a day?

	Response Percent	Response Count
Yes	**61.1%**	11
No	38.9%	7
answered question		**18**
skipped question		**0**

15. What supplements would you like to see with an outreach programme (such as a website, teaching manual, homework, PowerPoint presentation, etc.)?		
		Response Count
		16
	answered question	**16**
	skipped question	**2**

16. How would you like to see the Royal Armouries become more involved with you and your school?		
		Response Count
		8
	answered question	**8**
	skipped question	**10**

17. Additional comments or questions?		
		Response Count
		4
	answered question	**4**
	skipped question	**14**

18. If you would like to be contacted regarding the outreach programme, please provide contact details below:

	Response Percent	Response Count
Name:	**100.0%**	15
School:	**100.0%**	15
Address:	**100.0%**	15
Address 2:	80.0%	12
County/Borough	93.3%	14
Postal Code:	93.3%	14
Email Address:	93.3%	14
Phone Number:	80.0%	12
	answered question	**15**
	skipped question	**3**

6.1.1.8 Primary Teacher Survey – Question 2 Delineated

	Comment Text	Response Date
1.	west midlands	Fri, 6/13/08 3:58 PM
2.	camden	Wed, 6/11/08 2:06 PM
3.	Wakefield	Wed, 6/11/08 8:52 AM
4.	cheshire	Tue, 6/10/08 12:15 PM
5.	Cambridgeshire	Tue, 6/10/08 10:05 AM
6.	cambridgeshire	Mon, 6/9/08 4:45 PM
7.	Westminster	Mon, 6/9/08 3:42 PM
8.	Bristol	Mon, 6/9/08 2:27 PM
9.	stoke on trent staffordshire	Mon, 6/9/08 1:19 PM
10.	Cornwall	Mon, 6/9/08 12:05 PM
11.	Barking and Dagenham	Mon, 6/9/08 11:20 AM
12.	London Borough of Barking and Dagenham	Mon, 6/9/08 11:20 AM
13.	Bristol	Mon, 6/9/08 10:33 AM
14.	Barnet	Wed, 6/4/08 11:28 AM
15.	Barnet	Tue, 6/3/08 9:20 PM
16.	Bexley	Mon, 6/2/08 11:06 PM
17.	Barking and Dagenham	Mon, 6/2/08 1:06 PM
18.	Camden	Sun, 6/1/08 10:19 AM

6.1.1.9 Primary Teacher Survey – Question 4 Delineated

	Comment Text	Response Date
1.	30	Fri, 6/13/08 3:58 PM
2.	30	Wed, 6/11/08 2:06 PM
3.	24	Wed, 6/11/08 8:52 AM
4.	30	Tue, 6/10/08 12:15 PM
5.	32	Tue, 6/10/08 10:05 AM
6.	25	Mon, 6/9/08 4:45 PM
7.	7	Mon, 6/9/08 3:42 PM
8.	25	Mon, 6/9/08 2:27 PM
9.	30	Mon, 6/9/08 1:19 PM
10.	30	Mon, 6/9/08 12:05 PM
11.	29	Mon, 6/9/08 11:20 AM
12.	28	Mon, 6/9/08 11:20 AM
13.	21	Mon, 6/9/08 10:33 AM
14.	30	Wed, 6/4/08 11:28 AM
15.	30	Tue, 6/3/08 9:20 PM
16.	30	Mon, 6/2/08 11:06 PM
17.	30	Mon, 6/2/08 1:06 PM
18.	28	Sun, 6/1/08 10:19 AM

6.1.1.10 Primary Teacher Survey – Question 5 Delineated

	Comment Text	Response Date
1.	1	Fri, 6/13/08 3:58 PM
2.	KS2	Wed, 6/11/08 2:06 PM
3.	KS2	Wed, 6/11/08 8:52 AM
4.	1	Tue, 6/10/08 12:15 PM
5.	ks2	Tue, 6/10/08 10:05 AM
6.	2	Mon, 6/9/08 4:45 PM
7.	KS2 (actually prep - yrs 4 to 8 inc)	Mon, 6/9/08 3:42 PM
8.	Foundation Stage	Mon, 6/9/08 2:27 PM
9.	1	Mon, 6/9/08 1:19 PM
10.	ks2	Mon, 6/9/08 12:05 PM
11.	2	Mon, 6/9/08 11:20 AM
12.	2	Mon, 6/9/08 11:20 AM
13.	2 and 3	Mon, 6/9/08 10:33 AM
14.	Key Stage 2	Wed, 6/4/08 11:28 AM
15.	KS2	Tue, 6/3/08 9:20 PM
16.	2	Mon, 6/2/08 11:06 PM
17.	2	Mon, 6/2/08 1:06 PM
18.	Reception	Sun, 6/1/08 10:19 AM

6.1.1.11 Primary Teacher Survey – Question 15 Delineated

	Comment Text	Response Date
1.	teaching manual, PowerPoint presentations, websites	Fri, 6/13/08 3:58 PM
2.	Website, teaching manual & homework would all be great	Wed, 6/11/08 2:06 PM
3.	Smartnotebook presentation, website to follow-up learning	Wed, 6/11/08 8:52 AM
4.	interactive activities on website	Tue, 6/10/08 12:15 PM
5.	teaching manual or plans, powerpoint or IWB programme	Mon, 6/9/08 4:45 PM
6.	Explanatory notes for each object - ideally via website and so linked to other similar objects in your collection.	Mon, 6/9/08 3:42 PM
7.	website	Mon, 6/9/08 2:27 PM
8.	lesson plans and worksheets.	Mon, 6/9/08 1:19 PM
9.	Powerpoint presentation	Mon, 6/9/08 11:20 AM
10.	Power Point Homework Worksheets	Mon, 6/9/08 11:20 AM
11.	Powerpoint presentation and teaching manuals	Mon, 6/9/08 10:33 AM
12.	Homework	Wed, 6/4/08 11:28 AM
13.	teaching manual	Tue, 6/3/08 9:20 PM
14.	Power point/teaching manual	Mon, 6/2/08 11:06 PM
15.	Hard to know as have not seen the resources yet. This is also why I haven't been able to answer Q13.	Mon, 6/2/08 1:06 PM
16.	teaching manual with ideas linked to resources on the internet.	Sun, 6/1/08 10:19 AM

6.1.1.12 Primary Teacher Survey – Question 16 Delineated

	Comment Text	Response Date
1.	By visiting us and discussing with staff how your programme works	Fri, 6/13/08 3:58 PM
2.	not sure	Tue, 6/10/08 12:15 PM
3.	I don't know at the moment as I have never heard of this before	Mon, 6/9/08 4:45 PM
4.	Demonstations of explosives and firearms - always popular with boys!	Mon, 6/9/08 3:42 PM
5.	by providing materials for Foundation Stage	Mon, 6/9/08 2:27 PM
6.	visits and talks at the school	Mon, 6/9/08 1:19 PM
7.	Local Exhibitions using English Heritage sites and well advertised - long notice access for schools	Mon, 6/9/08 12:05 PM
8.	Visits	Wed, 6/4/08 11:28 AM

6.1.1.13 Primary Teacher Survey – Question 17 Delineated

	Comment Text	Response Date
1.	Do you do school visits anywhere in the country or do we have to come to you?	Fri, 6/13/08 3:58 PM
2.	Waht other subjects can you offer?	Wed, 6/11/08 8:52 AM
3.	I think you have a very good idea using the box, but it costs us too much as a school, and takes us too long to get to you, so we will not be making use of your programme. Sorry	Tue, 6/10/08 10:05 AM
4.	I am a Librarian and organise loans of topic boxes not a teacher. I will forward these to the relevant departments.	Mon, 6/9/08 10:33 AM

6.1.1.14Primary Teacher Survey – Question 18 Delineated

Teacher	School	Address	Town	County	Postal Code
Michelle Ashley	Holy Family school	Coventry Road	Small Heath	Birmingham	B10 0HT
Lucy Giverin	St Dominics Catholic primary	Southampton road	kentish Town	London	NW5 4JS
Emma Carpenter	Roundhill Juniors	Hampden Close	Ferrybridge	Wakefiled	Wf11 8PT
L Collinson	Swavesey Primary School	Middle Watch	Swavesey	Cambridge	CB24 4RN
Kevin Cook	Upwood Primary School	Huntingdon Road	Upwood	Cambs	Pe26 2qa
Chris Hedges	Westminster Abbey Choir School	Dean's Yard		Westminster	SW1P 3NY
Mrs V Taylor-Bradbury	John Baskeyfield Primary School	Westport Road	Burslem	Stoke on Trent	st6 4jg
FAO Bob Eldridge	Marlborough School	Ferndale Road	Falmouth	Cornwall	TR11 4HU
Mrs E Davies	Warren Junior School	Gordon Road	Chadwell Heath, Romford	Essex	RM6 6DA
Ross McTaggart	Henry Green Primary School	Green Lane	Dagenham	Essex	rm8 1ur
Rebecca Clear	Clifton College Preparatory School	Tha Avenue	Clifton	Bristol	BS8 3HE
Fiona Montgomery	St. Agnes RC Primary School	Thorverton Road	Cricklewood	London	NW2 1RG
Sue Silk	Monkfrith	Knoll Drive	Southgate	London	N14 5NG
Karen Paine	Burnt Oak Junior School	Burnt Oak Lane	Sidcup	Kent	BR8 7RR
Jonathan Smith	St Josephs Catholic Primary School	Macklin Street	London	Camden	WC2B 5NA

Teacher	Email	Phone Number
Michelle Ashley	michelle.ashley7@googlemail.com	0121-675-2670
Lucy Giverin	deputylg@stdominics.camden.sch.uk	0207 4855918
Emma Carpenter	ecarpenter@roundhill.wakefield.sch.uk	
L Collinson		
Kevin Cook	the.cookies@ntlworld.com	01487 813510
Chris Hedges	chris.hedges@westminster-abbey.org	07736 770200 (M)
Mrs V Taylor-Bradbury	vtaylorbradbury@sgfl.org.uk	01782 234950
FAO Bob Eldridge	bobeldridge@marlborough.cornwall.sch.uk	01326 314636
Mrs E Davies	edavies@warren-j.bardaglea.org.uk	0208 270 4680
Ross McTaggart	rmctaggart@henrygreen.bardaglea.org.uk	2082704463
Rebecca Clear	RClear@clifton-college.avon.sch.uk	0117 3157 513
Fiona Montgomery	montgomery.stagnes.barnet@lgfl.net	0208 4524565
Sue Silk	russell.silk@btopenworld.com	0208 368 6020
Karen Paine	KazPaine@dsl.pipex.com	0208 300 5854
Jonathan Smith	ict@stjosephs.camden.sch.uk	

Appendix H: Personal Email Raw Survey Results

Royal Armouries at the Tower of London

1. What's you gender?

		Response Percent	Response Count
Male		0.0%	0
Female		**100.0%**	2
	answered question		**2**
	skipped question		**0**

2. What county [borough] do you teach in?

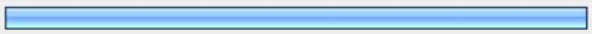
	Response Count
	2
answered question	**2**
skipped question	**0**

3. What is your age?

		Response Percent	Response Count
20-35		0.0%	0
35-50		**100.0%**	2
50-65		0.0%	0
65+		0.0%	0
	answered question		**2**
	skipped question		**0**

4. On average how many students are in your classes?		
		Response Count
		2
	answered question	**2**
	skipped question	**0**

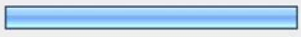
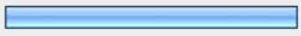
5. What key stage do you primarily teach?		
		Response Count
		2
	answered question	**2**
	skipped question	**0**

6. Have you visited the Tower previously with your students?			
		Response Percent	Response Count
Yes		0.0%	0
No		**100.0%**	2
	answered question		**2**
	skipped question		**0**

7. Please rank which forms of contact you are more likely to respond to:

	1(least likely)	2	3	4	5 (most likely)	Rating Average	Response Count
Mailings	0.0% (0)	0.0% (0)	0.0% (0)	**100.0% (2)**	0.0% (0)	4.00	2
Email	**50.0% (1)**	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	3.00	2
Websites	**50.0% (1)**	**50.0% (1)**	0.0% (0)	0.0% (0)	0.0% (0)	1.50	2
Direct, personal phone calls	0.0% (0)	0.0% (0)	**100.0% (2)**	0.0% (0)	0.0% (0)	3.00	2
Newsletters	0.0% (0)	**50.0% (1)**	0.0% (0)	0.0% (0)	**50.0% (1)**	3.50	2
						Other	0
						answered question	**2**
						skipped question	**0**

8. Have you utilised any outreach programmes or outreach materials in your curriculum before?

		Response Percent	Response Count
Yes		**50.0%**	1
No		**50.0%**	1
	answered question		**2**
	skipped question		**0**

9. When would you need to know about the loan box programme to successfully plan a programme in your classroom?

	Response Percent	Response Count
2 weeks before	**50.0%**	1
4 weeks before	**50.0%**	1
6 weeks before	0.0%	0
8 weeks before	0.0%	0
Other (please specify)	0.0%	0
	answered question	**2**
	skipped question	**0**

10. Would school incentives increase your interest in the programme?

	Response Percent	Response Count
Yes	**100.0%**	2
No	0.0%	0
	answered question	**2**
	skipped question	**0**

11. Would your school be able to cover transportation costs for the loan box?

	Response Percent	Response Count
Yes	**100.0%**	2
No	0.0%	0
	answered question	**2**
	skipped question	**0**

12. Would you use the loan box programme (Key Stage 2, Key Stage 3)?

	Response Percent	Response Count
Yes	**100.0%**	2
No	0.0%	0
answered question		**2**
skipped question		**0**

13. How would you use the loan box programme?

	Response Percent	Response Count
In lieu of a visit to the museum	**50.0%**	1
Before a visit to the museum	0.0%	0
After a visit to the museum	0.0%	0
Before and after a visit to the museum	**50.0%**	1
answered question		**2**
skipped question		**0**

14. Would you prefer someone to accompany the loan box to aid in teaching it for a day?

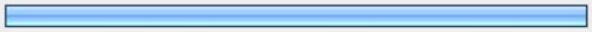
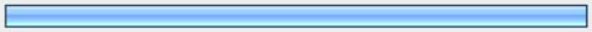
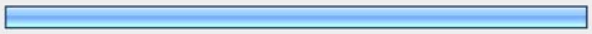
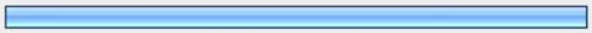
	Response Percent	Response Count
Yes	**100.0%**	2
No	0.0%	0
answered question		**2**
skipped question		**0**

15. What supplements would you like to see with an outreach programme (such as a website, teaching manual, homework, PowerPoint presentation, etc.)?		
		Response Count
		2
	answered question	**2**
	skipped question	**0**

16. How would you like to see the Royal Armouries become more involved with you and your school?		
		Response Count
		1
	answered question	**1**
	skipped question	**1**

17. Additional comments or questions?		
		Response Count
		0
	answered question	**0**
	skipped question	**2**

18. If you would like to be contacted regarding the outreach programme, please provide contact details below:

		Response Percent	Response Count
Name:		**100.0%**	1
School:		**100.0%**	1
Address:		**100.0%**	1
Address 2:		0.0%	0
County/Borough		**100.0%**	1
Postal Code:		**100.0%**	1
Email Address:		**100.0%**	1
Phone Number:		**100.0%**	1
	answered question		**1**
	skipped question		**1**

Appendix I: Teacher Interview Questionnaire

Loan Box Programme Teacher Questionnaire (Follow-up questions for after the presentation of the loan box-based lesson)

Would you use the loan box in your curriculum?

What do you think were the strongest aspects of the lesson?

What do you think were the weakest aspects of the lesson?

Would you prefer to have a:

- Pre-made lesson plan included with the loan box?
- Several lesson plan templates included with the loan box?
- Several experiments outlined, so you could develop your own lesson plan based on the loan box?

Would you be comfortable teaching the loan box with the provided teaching supplements and materials?

Do you feel that any of the experiments could be improved? If so, how?

Other comments or questions:

Appendix J: Experiments

ROYAL ARMOURIES

Student Name: _____
Group Members: _____
_____
_____

Date: _____
Course: _____
Instructor: _____

Makin' Casein

Time: 20-25 minutes

Materials:
-125cm³ of whole milk
-40cm³ of white vinegar
-food coloring (optional)

Lab Equipment:
-filter paper
-beaker
-mixing spoon
-Bunsen burner

Introduction

Background:
Milk is a mixture of water, fat, proteins, vitamins, minerals, acids, enzymes and gases. Casein is the dominant protein making up 80% of the total milk protein. In this experiment you will separate this protein out of the milk using heat and acetic acid.

Hazards:
Use proper hand and eye protection during this experiment
Vinegar can be harmful if swallowed

Experiment

Procedure:
1. Measure the milk and place in the beaker. Slowly warm the milk, but do not boil.
2. Add several drops of food coloring to the milk so the object you form will be coloured. Remove the pan from the heat. Slowly add the vinegar into the milk in the pan.
3. Use your strainer to separate the solid that has formed from the liquid in the pan. This solid is a plastic.
4. After the liquid has drained through the strainer, pour a little water through the strainer to rinse the plastic.
5. Form the plastic into a ball and set it on a paper towel for a few minutes to remove some of the excess moisture.
6. You should then be able to form the plastic into the object of your choice.
7. When you have finished shaping your object, set it aside for a week to dry. The object will probably shrink a little as it dries out.

Review Questions:

1. What does the plastic you produced feel like? What does it remind you of?

_____
_____

2. Why does milk, when mixed with vinegar produce a solid?

_____
_____

Fun facts: Cheese is made from curds. White glue is made from the casein of the curds. The name casein comes from *caseus*, which is Latin for cheese.

ROYAL ARMOURIES

Student Name: _____
Group Members: _____
_____
_____

Date: _____
Course: _____
Instructor: _____

Makin' Casein

Time: 20-25 minutes

Materials:

-125 cm^3 of whole milk
-25 cm^3 of white vinegar
-5 cm^3 of Sodium hydrogen carbonate (baking soda)

Lab Equipment:
-beaker (250 cm3)
-stirring rod
-filter funnel
-filter paper
-paper towel
-conical flask (250 cm3)

Introduction

Background:
Milk is a mixture of water, fat, proteins, vitamins, minerals, acids, enzymes and gases. Casein is the dominant protein making up 80% of the total milk protein. In this experiment you will separate this protein out of the milk using heat and acetic acid.

Hazards:
-Use proper hand and eye protection during this experiment
-Vinegar can be harmful if swallowed

Experiment

Procedure:
1. Measure out about 125 cm^3 of whole milk into the 250 cm^3 beaker.
2. Add about 25 cm^3 of vinegar and place the beaker on the tripod under a medium heat.
3. Gently heat the beaker, stirring constantly, until small lumps begin to form.
4. Once the lumps appear, remove the beaker from the heat, and continue to stirring until the lumps stop forming
5. Allow the substance to settle, and then remove some of the liquid. Filter off the remainder of the liquid into the conical flask using the funnel and filter paper.
6. Use the paper towel to remove excess liquid from the substance.
7. Transfer the dried out substance to the empty beaker, add about 15 cm^3 of water and stir.
8. Add about 3 cm^3 of sodium hydrogen carbonate. Once bubbles of gas appear, add the remaining sodium hydrogen carbonate until it stops bubbling.
9. Stir the solid. What has been created? Hypothesize how this happened?

Review Questions:

1. Why does milk, when mixed with vinegar produce a solid?

_____
_____

2. What if you replace the vinegar with another acid? What about lemon juice?

_____
_____

ROYAL ARMOURIES

Student Name: _____ Date: _____
Group Members: _____ Course: _____
_____ Instructor: _____
_____

Protecting the Future

Time: 30-40 minutes

Materials:

Everyday polymers:

- rubbish/plastic bags
- fizzy drink bottles
- milk cartons
- duct tape
- plastic gloves
- cling wrap
- tights/stockings
- Styrofoam plate
- egg carton
- plastic cups
- plastic hair clips
- chewing gum
- cardboard
- bow wrap

Introduction

Background:

The Royal Armouries has a vast collection of body protection dating back to the 15th century. Today, they strive to educate the public on not only their armour collection, but the advancements in body protection today. One example modern body protection is Kevlar, which can resist a slashing from a knife. In this activity, you will examine different types of old and new body protection. Then, in groups assigned by your instructor, create body armour of your own.

Design Activity

Procedure:

Your class has been hired by OmniGuard, a company which specializes in 'smart material' body protection. Each team is to design a prototype of a 'futuristic' type of protection using the materials supplied. The protection can be designed for any part of the body your team decides upon. Remember to consider comfort and flexibility as well as safety and durability in your design. For example, if your group is designing protection for the legs, be sure they are flexible at the knees and will allow the user to still run comfortably. Be creative in your design. Remember, it's only a prototype so anything is possible.

Review Questions:

1. What are some advancements seen in the armour over time?

_____

_____

2. When designing your armour, what were the most important aspects to think about?

_____

_____

3. How might the advancements in today's body protection change our world?

_____

_____

ROYAL ARMOURIES

Student Name: _____
Group Members: _____
_____
_____

Date: _____
Course: _____
Instructor: _____

Secret State

Time: 10 minutes

Materials:

-300g corn flour
-250cm³ water

Lab Equipment:
-metal mixing bowl
-spoon

Introduction

Background:

In this experiment, your group is going to create a dilatant material, also known as a shear-thickening fluid, using only corn flour and water. The viscosity ("thickness") of dilatant materials increases as the force, or shear, on them increases. When pressure is applied to the corn flour substance it will become a solid. If pressure is no longer applied, it will return to a liquid state.

Experiment

Procedure:

1. Mix the corn flour with the water in the metal mixing bowl.
2. Stir the mixture until it becomes difficult to move the spoon. Tip the bowl and then stir the mixture again vigorously.
3. Drip your finger slowly in the liquid until it touches the bottom of the bowl. Then pull it out in a hurry and it will solidify.
4. Quickly drag your fingers through the liquid and lift out a putty-like ball that you can work in your hands. Be sure to keep your hands over the bowl and then open your fingers.
5. Discuss amongst your group how this is possible.

Review Questions:

1. Where else can shear thickening fluids be found?

_____
_____

2. How can shear thickening fluids change the way we design armour?

_____
_____

3. Hypothesize how a shear thinning fluid might work.

_____
_____
_____

ROYAL ARMOURIES

Student Name: _____
Group Members: _____
_____
_____

Date: _____
Course: _____
Instructor: _____

'Melting' Polystyrene

Time: 10 minutes

Materials:

-20cm³ of acetone
-200cm³ of water
-Polystyrene cups
-pipette

Lab Equipment:
-2 large beakers or containers

Introduction

Background:
Polymers are made up of long chains of monomers. These long chain polymers are held together loosely by non-polar bond interactions between chains. Polystyrene is made as foam, therefore, it has air space in between these groups of polymers.

Hazards:
-Use proper hand and eye protection during this experiment
-WARNING: Acetone is a extremely flammable liquid and is harmful if swallowed, inhaled or comes in contact with skin. Use with caution!

Experiment

Procedure:

1. Place two large glass beakers side-by-side. Pour water into the first beaker until it's about half full and leave the second one empty.
2. Place a Polystyrene cup into the beaker that contains the water and observe what happens. The cup simply floats and is not affected by the water.
3. Place a Polystyrene cup into the empty beaker and using a pipette, take a small amount of acetone place several drops on the Polystyrene and observe what happens. The Polystyrene slowly breaks down until it appears as a glob of goo.
4. The goo that results from the dissolving Polystyrene is still the same polymer as the Polystyrene cup in a different state.

Review Questions:

1. Predict why the acetone made the Styrofoam harden. Use the information you learned in the background section to support your answer.

_____
_____

2. What properties does water have that distinguish it from acetone?

_____
_____

Appendix K: Lesson Plan

Polymer Structure and Plastics Lesson Plan

This lesson introduces the concepts of plastics and their molecular structure. It is ideal for classes with a base knowledge of molecules and polymers. First it introduces the concepts and then provides hands on activities to reinforce these concepts. These concepts are then tied to pieces of armour and their historical significance. We would suggest groups of 3 for the experiment.

Supplies Provided:

- White Vinegar
- Dish Cloth or Muslim Cloth
- Balloons
- Kebabs
- Cooked Spaghetti
- Corn Flour

Supplies Required (per group):

- 125 mL whole milk
- Two large beakers
- One small beaker
- Stirring rod
- Bunsen burner
- Thermometer
- Paper Towels
- Tongs to remove beaker from Bunsen burner

Introduction:

(The introduction is supposed to get kids to think about their surroundings and really engage in the concepts of materials)

Many eras in history have been named after the dominant materials used at the time? Can anyone give me an example? Copper, Bronze, Iron, etc.

These are the three things we want you to learn from today's experiments:
What is a polymer?
What makes polymer's special?
Polymer's vs. Metals

If you could name this era, what material would you name it after? (Ideal answer would be to get to plastics.)

Now the question is, what is a polymer?

(The following questions are meant to gauge where to start the lesson and how much needs to be explained before starting discussion on plastics)

How many people know what an atom is?
How many people know what makes up a molecule? Atoms join together to create molecules
Polymers are chains of these molecules joined together.

(Possibly use the kids as examples, tell them they are molecules and have them line up and link arms to visualize what a polymer is.)

Polymers have a backbone of carbon that makes chains of them flexible, much like cooked spaghetti. Can anyone guess what happens the longer the chain of polymers gets? Think about what happens to cooked spaghetti when you have long pieces of them and put them in a bowl together.

They get tangled up in each other and create a more solid mass, the same thing happens with polymers.

Can we get a volunteer? Here we have_____ and what he/she is going to do is take this kebab and stick it through the balloon without popping it. (Please reference attached experiment Balloon Kebabs. This experiment keeps the kids interested and is an interesting way to model the concept of polymer chains when they are relaxed as opposed to under tension)

Note where the kebab is, what do you think would happen if I inserted it into the side? Well let's try it and find out (balloon pops). Anyone want to guess why the balloon popped? (When polymer chains are relaxed they can fill in around the kebab allowing the balloon to remain inflated. An easy way to show this is to take a handful of the spaghetti in a clump and put the kebab through it. The tip weaves its way through the spaghetti

without breaking any strands, and this is what happens in the relaxed parts of the balloon essentially. To show what happens when the kebab is poked into the side of the balloon, pick up a few strands of the spaghetti and pull them straight without breaking them. Under tension this is what polymer chains do and then pull on the spaghetti so it breaks, and when either too much tension is applied and one breaks, they all break.)

EXPERIMENT- Makin Casein – Please refer to the attached experiment. Discussion of the questions included at the bottom is at your own discretion. (The milk precipitates out of the solution because the acidity of the vinegar changes the shape of the protein casein in the milk and the "holders" that they once had (visualizing a puzzle where all the pieces fit together) have been misshapen. This causes them to no longer be suspended in the liquid and precipitate.)

This Casein you just made is a polymer similar to that which was made as far back as 1500's, when Native American children made balls to play with from rubber trees. This particular kind of casein was used in the early 1900's to make buttons, pens, and many things that we still make out of plastic today.

Does anyone know what plastics are made out of now? (Oil) What is the current problem with this? (Depending on time and need you can discuss the current issues with oil production and relying on it as a natural resource)

What do you think would be the downside of creating plastics this way? Smell, degradation. How can we prevent this? (Coat it in formaldehyde.) Does anyone know when plastics really came to be popular? (Not until the 1980's.)

(Use PowerPoint slides on properties, to discuss these materials using scientific terms.)

If these weren't around until the 1980's what did they make things out of before that? (Metal.) What has armour traditionally been made out of? (Metal.)

Now, if you think about putting on a suit would you rather have it be made out of metal or plastic? (Here discuss the properties of each depending on feedback from the class. Odds are some will pick metals and some will pick plastics.)

Please Reference Secret State Experiment Attached
(We would suggest making Secret State material before the class begins and just have the children feel it as opposed to making it.)

Now coming around is a bowl of what looks like just liquid, but run your finger through, what do you notice happens? Grab a little in your hand and squeeze into a fist, then open it back up, what do you notice is unique about this material? (The liquid feels like a

solid when you close your hand around it, but when you open your fist up it turns back into a liquid.)

This is called a shear-thickening fluid. When place it under pressure it will resist deformation and become solid. Once the pressure is removed it will become liquid again. (The strands of molecules in the liquid are random and flow like liquid. When pressure is applied the molecules align and create a solid-like substance. The interesting thing is that if something is drawn through at a slow pace it can pass through the shear thickening fluid as liquid. It takes sudden impact or compression of the fluid to create a solid.)

What could you use this in? (Shear thickening fluids are being researched and used in body protection applications. One polymer that was discovered was Kevlar, this material is knife resistant and used in riot gear, gloves and aprons for butchers, and things along those lines. To improve the properties of Kevlar they have begun to soak it in shear thickening fluids. Kevlar, usually penetrable by an ice pick, becomes impenetrable to the ice pick once soaked in the shear thickening fluid. These shear thickening fluids do not return to liquid they stay solid.)

Appendix L: Website Design Recommendations

27 June, 2008

Website Content Integration Proposal

Royal Armouries at HM Tower of London
Loan Box Programme

Lena DesPlaines

Michael Ferro

Matt Kurtz

Initial Concept of Proposal

The following pages detail a set of recommendations for the implementation of content in the learning section of the Royal Armouries at HM Tower of London's website. The group based the content and organizational recommendations off of input received from the Royal Armouries at HM Tower of London, survey data collected from both secondary and primary teachers, input received via teachers in the classroom, and actual classroom teaching experience gained through the project. The group hopes that these recommendations will be used as a guideline in determining how to best provide both resources and marketing material for the loan box on the internet.

Below you will find a breakdown of the current navigation scheme under the learning tab on the Royal Armouries at HM Tower of London website. (http://www.royalarmouries.org/learning/student-groups-at-ra-tower-of-london) The titles highlighted and bolded in red indicate how the group believes the **Science Outreach** section should be broken down. Additionally, titles highlighted in blue are sections the group has developed and provided recommendations for content inclusion on the website for the Loan Box Programme.

Current navigation scheme and recommended changes & additions:

- Student Groups at RA Tower of London
- Downloads for Your Visit – RA Tower of London
- Material Science
    - Key Stage 1
    - Key Stage 2
    - Key Stage 3
    - Key Stage 4
- AS and A Level
- Science Outreach and Access
    - Science Outreach
        - **Loan Box Programme/** Introductory page
            - **Included Experiments**
            - **Example Lesson Plans**
            - **Loan Box Customization**
            - **Curriculum Fulfilments**
            - **Using the Loan Box!**
        - **Object Based Material Science Session**
        - **Perfecting Progression – Amazing Armour**
    - Access Sessions
    - Early Years Sessions
    - Community
- Booking a Visit
- Pre-visit familiarisation
- Prices

Introductory Page

The Loan Box Programme is a unique programme, but even when a brief description is provided to teachers, they often fail to understand what it is or how they could utilise it in their classroom and with the curriculum. With this understanding, an introduction has been written below which provides for a general understanding of the concept of what the Royal Armouries Loan Boxes are and hopefully entices teachers to further explore the website to gain a more detailed understanding of it and contact the Royal Armouries to utilise it.

Suggested Introductory Page:

The Royal Armouries at HM Tower of London has recently put together two science based loan boxes. One of which is intended to help bridge the science curriculum between years 5, 6, and 7 by introducing children in an exciting way to the new concepts of material science that key stage 3 entails. The loan box is an outreach programme created to aid in teaching material science, generate interest in the sciences, and reinforce concepts of material science through hands-on learning techniques. There are currently two loan boxes, a polymers box and a metals box. The polymers box provides a series of experiments and teaching resources to help teachers convey materials science through hands-on learning. The metals box also includes artefacts and teaching resources. We encourage you to browse through the website to gain a better understanding of how you can use the loan boxes in your classroom.

Suggestion: include a picture of both loan boxes on this page for visual reinforcement.

Included Experiments

In order to convey what the loan box is and includes, it is important that an example of the experiments provided to teachers is included on the website. Through examples, teachers will also be provided the opportunity to better communicate with the Royal Armouries their needs, so that when they do utilise the loan box it is an exceptional experience that they would seek to repeat in the future.

Suggested Included Experiments Page:

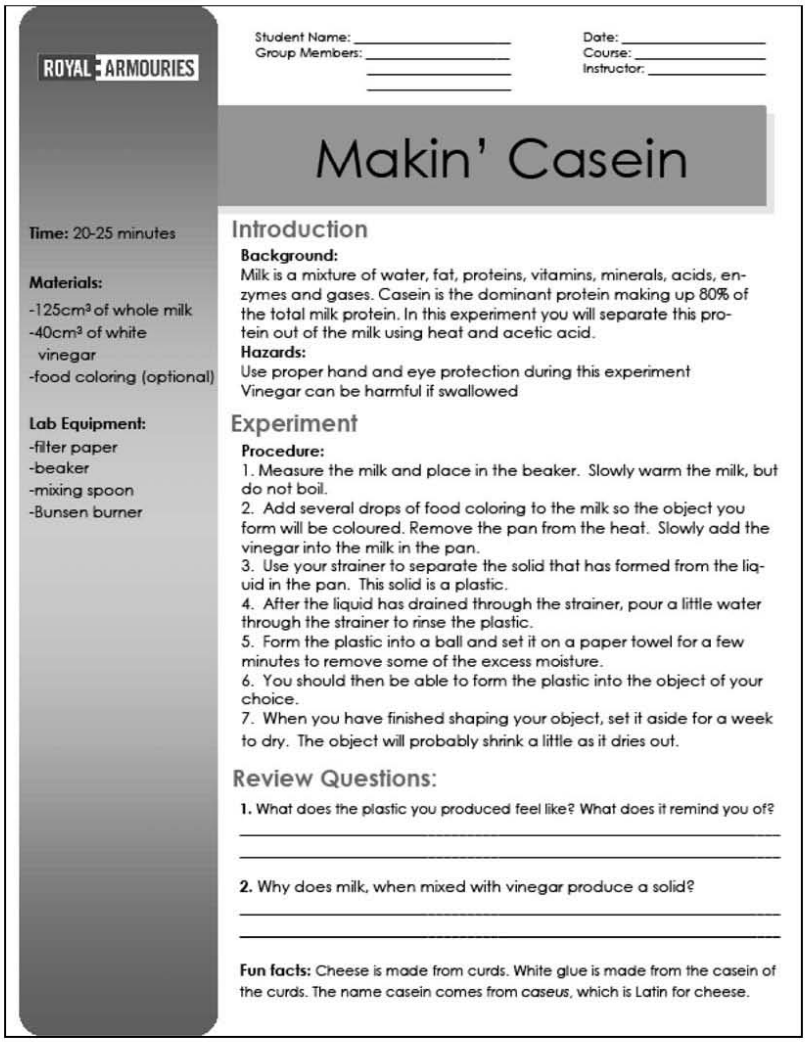
The loan box includes an array of six different experiments that may be utilised in your classroom. Below you will find a table that lists all six experiments and which years will benefit most from them. Additionally, you will find the PDF for one of the experiments below and several pictures of the results from it in the classroom.

The experiment pictured to the right is entitled Makin' Casein, and highlights the earliest discovered form of a polymer. The lesson plan for this experiment provides support for teachers to talk about how plastics came to light and how originally the synthetic material Casein was made from a natural material (curdled milk). This experiment provides a nice introduction for a material science unit, and is complimented by several other experiments in the loan box.

In addition to the experiment sheets provided with the loan box, there is also a PowerPoint presentation that will aid in teaching each experiment and concepts.

(Suggested Included Experiments Page – Continued)

Makin' Casein Experiment Sheet:
(Include it as an image on the page, and disable right-click so it isn't easily copied off the page)



ROYAL ARMOURIES

Student Name: _____ Date: _____
Group Members: _____ Course: _____
_____ Instructor: _____
_____

Makin' Casein

Time: 20-25 minutes

Materials:
-125cm³ of whole milk
-40cm³ of white vinegar
-food coloring (optional)

Lab Equipment:
-filter paper
-beaker
-mixing spoon
-Bunsen burner

Introduction

Background:
Milk is a mixture of water, fat, proteins, vitamins, minerals, acids, enzymes and gases. Casein is the dominant protein making up 80% of the total milk protein. In this experiment you will separate this protein out of the milk using heat and acetic acid.

Hazards:
Use proper hand and eye protection during this experiment
Vinegar can be harmful if swallowed

Experiment

Procedure:
1. Measure the milk and place in the beaker. Slowly warm the milk, but do not boil.
2. Add several drops of food coloring to the milk so the object you form will be coloured. Remove the pan from the heat. Slowly add the vinegar into the milk in the pan.
3. Use your strainer to separate the solid that has formed from the liquid in the pan. This solid is a plastic.
4. After the liquid has drained through the strainer, pour a little water through the strainer to rinse the plastic.
5. Form the plastic into a ball and set it on a paper towel for a few minutes to remove some of the excess moisture.
6. You should then be able to form the plastic into the object of your choice.
7. When you have finished shaping your object, set it aside for a week to dry. The object will probably shrink a little as it dries out.

Review Questions:

1. What does the plastic you produced feel like? What does it remind you of?
_____
_____

2. Why does milk, when mixed with vinegar produce a solid?
_____
_____

Fun facts: Cheese is made from curds. White glue is made from the casein of the curds. The name casein comes from caseus, which is Latin for cheese.

(Suggested Included Experiments Page – Continued)

The following table includes a list of experiments included with the box and the suggested year for which to use them in.

Year 7 & 8	Properties of Materials	- Protecting the Future - Melting Polystyrene - Secret State
Year 9 & 10	Molecular Structure and the Chemistry of Polymers	- Secret State - Makin' Casein - Melting Polystyrene - Balloon Kebabs

Suggestion: Include photos of classrooms that the loan box has been utilised in. Additionally, if possible provide a couple of teacher testimony lines.

Example Lesson Plans

As with the experiments section, the group believes it would be extremely useful to include example lesson plans for teachers to review. This would allow them to convey to the Royal Armouries what they are looking for outcomes from the loan boxes and how and when they believe they could best utilise them in their classroom.

Suggested Example Lesson Plans to Include:

While the loan box is completely customizable, and teachers are certainly welcome to take the experiments and build their own lesson plans for them, the Royal Armouries has also provided a sample lesson plan for the experiments. These lesson plans may be used in their entirety, modified to your needs, or you may base your own off of them.

(Include a link to the PDF Polymer Structure and Plastics file here)

Loan Box Customisation

While some teachers have experience in the area of material science, there are many who don't. Acknowledging this, the group believes that including a page dedicated to explaining how the loan box can be customised to each teachers needs will increase interest and usage of it.

Suggested Loan Box Customisation Page:

The loan box programme has been designed to offer you an alternative to teaching material science through lectures or a book. It has interactive experiments and lessons, which we hope will increase your students' interest in the subject matter and aid you in more effectively teaching the concepts. With this in mind, we have ensured that the loan box programme is fully customizable, and can be configured to meet your needs. When you contact us to use the loan box, we will be happy to discuss your needs and work to best fit the programme into your curriculum.

Curriculum Fulfilments

Since England's school systems are required to follow the QCA's curriculum, it is important that any outside programmes a teacher uses fit into and supplement the curriculum they are teaching. In order to demonstrate how the loan box programme fits into the national curriculum the group suggests including a full page in the website which explains how it fits into the curriculum, for those teachers who are interested.

Additionally, to ensure that this page is interesting, informative, and not too lengthy, the group would suggest that it be broken down by experiment, where you have an image for each experiment, and when you click on it you will be taken to another page which displays the curriculum integration information.

Suggested Curriculum Fulfilments Page:

Each experiment in the loan box programme is fully integrated into the QCA curriculum. We have provided a list of experiments and which concepts they cover below. Click on the images below to see the curriculum fulfilments of each experiment.

(Each image should be on one page, and then each corresponding table should appear when you click on the image in a separate window)

(Suggested Curriculum Fulfilments Page – Continued)

Balloon Kebabs

Experiment	Examination Board Standards
Balloon Kebabs	**Key Stage 3:** **QCA** Science Standards: Unit 8E (atoms and elements) **Key Stage 4:** **OCR** Science in the 21st Century: Science Suite Science in the 21st Century: Chemistry A Chemistry – Structure and bonding **QCA** The properties, characteristics, and features of materials that affect: ○ ability to be shaped and formed ○ ability to be treated ○ ease of handling ○ availability, form and supply

(Suggested Curriculum Fulfilments Page – Continued)

Secret State

Experiment	Examination Board Standards
Secret State	**Key Stage 3:** **QCA** Science Standards: Unit 7F (simple chemical reactions) Unit 8F (compounds and mixtures) Unit 9H (using chemistry) **Key Stage 4 (GCSE Standards):** **OCR** • The Unique Properties of Water – Breaking and Forming bonds through condensation and evaporation **QCA** • Engineering Materials – Polymers, Composites that combine the properties of different materials • The properties, characteristics, and features of materials that affect: o ability to be shaped and formed o ability to be treated o ease of handling o availability, form and supply • Engineering processes: o Shaping and manipulation o Heat and chemical treatment • New technology used in and by the engineering industries o Modern and 'smart' materials and components • The Impact of modern technologies o Advantages and Disadvantages that the use of modern technology has brought to society • Engineered products: o Investigate a variety of engineered products that use modern technology **AQA** • 11.4 – How are polymers made from oil? • 12.1 – How do sub-atomic particles help us to understand the structure of substances? • 12.2 – How do structures influence the properties and uses of substances • 12.5 – Do Chemical Reactions always release energy? • 13.2 What are strong and weak acids and alkalis? How can we find the amounts of acids and alkalis in solutions? • 13.4 How much energy is involved in chemical reactions?

(Suggested Curriculum Fulfilments Page – Continued)

Makein' Casein

Experiment	Examination Board Standards
Makin' Casein	**Key Stage 3:** **QCA** Science Standards: Unit 8F (compounds and mixtures) Unit 9H (using chemistry) **Key Stage 4 (GCSE Standards):** **GCSE Standards:** **OCR** • Chemistry – Structure and Bonding • The Unique Properties of Water – Electro negativity, exchange of electrons **QCA** • QCA Engineering Materials – Polymers, Composites that combine the properties of different materials • The properties, characteristics, and features of materials that affect: o ability to be shaped and formed o ability to be treated o ease of handling o availability, form and supply **AQA**
	• 12.5 – Do Chemical Reactions always release energy? • 13.2 What are strong and weak acids and alkalis? How can we find the amounts of acids and alkalis in solutions? • 13.4 How much energy is involved in chemical reactions? **EDEXCEL**: Module 4: Chemistry in Action Topics: • Enzymes

(Suggested Curriculum Fulfilments Page – Continued)

Protecting the Future

(Image)

Experiment	Examination Board Standards
Protecting the Future/Nanomaterials and Smart	**Key Stage 3:** **QCA** **Science Standards:** Unit 7K (forces and bonding)
Technology	**D&T Standards:** Unit 07aii (Understanding Materials Focus: Resistant Materials) Unit 08aii (Exploring Materials Focus: Resistant Materials) Unit 08bii (Designing for Clients Focus: Resistant Materials) **Key Stage 4 (GCSE Standards):** **QCA** • Engineering processes: o Shaping and manipulation o Heat and chemical treatment • New technology used in and by the engineering industries o Modern and 'smart' materials and components • The Impact of modern technologies o When engineering a product o On engineered products o On engineering industries o On stages in engineering a product o Advantages and Disadvantages that the use of modern technology has brought to society • Engineered products: o Investigate a variety of engineered products that use modern technology o Investigate the impact of modern technology on the design and production of a range of engineered products. **AQA** • 11.1 – How do rocks provide building materials? • 11.3 – How do we get fuels from crude oil? • 11.4 – How are polymers made from oil? • 12.1 – How do sub-atomic particles help us to understand the structure of substances? • 12.2 – How do structures influence the properties and uses of substances

(Suggested Curriculum Fulfilments Page – Continued)

Melting Polystyrene

(Image)

Experiment	Examination Board Standards

Melting Polystyrene	**AQA**
	• Chemistry Section 1
	  ○ *11.1 – How do rocks provide building materials?*
	• Chemistry Section 2
	  ○ *12.1 – How do sub-atomic particles help us to understand the structure of substances?*
	  ○ *12.2 – How do structures influence the properties and uses of substances?*
	QCA (for GCSE engineering)
	• *The properties, characteristics and features of materials that affect:*
	  ○ *Ability to be shaped and formed*
	  ○ *Ability to be treated*
	• *Engineering processes:*
	  ○ *Shaping and manipulation*
	  ○ *Heat and chemical treatment*
	OCR
	GCSE Science Guide Sections:
	• *Chemical and Material Behaviour*
	• *Structure and Bonding*
	Edexcel
	Module 4: Chemistry in Action
	Topics:

(Suggested Curriculum Fulfilments Page – Continued)

Polymer Demonstration

(Image)

Experiment	Examination Board Standards
Polymer Hands-On Demonstration	**Key Stage 3:** **QCA** Science Standards: Unit 8E (atoms and elements) Unit 7K (forces and effects)
	D&T Standards: Unit 08aii (Exploring Materials Focus: Resistant Materials) **Key Stage 4:** **OCR** Science Guide Sections: o Chemistry – Structure and bonding **AQA**: Unit Chemistry 1: 11.1 – How do rocks provide building materials? 11.3 – How do we get fuels from crude oil? 11.4 – How are polymers made from oil? Unit Chemistry 2: 12.1 – How do sub-atomic particles help us to understand the structure of substances? 12.2 – How do structures influence the properties and uses of substances 12.3 – How much can we make and how much do we need? 12.5 – Do Chemical Reactions always release energy? **QCA**: Engineering materials and the properties in the following groups: • Polymers • Composites that combine the properties of different materials The properties, characteristics and features of materials that affect: • Ability to be shaped and formed • Ability to be treated • Availability, form and supply **EDEXCEL**: Module 4: Chemistry in Action Topics: • Crude Oil • Plastics • Types of Chemical Reactions

Using the Loan Box – Contact Info

This page is simply designed as a contact page. The group believes in order to encourage prompt replies; this page should link directly to an education officer's email. Additionally, to discourage spam and encourage actual inquires, it is suggested that this page consist of a few brief words and then both a phone number, address, and simple contact form. That way, even though teachers are most likely to submit inquiries through email, they have the option of contacting the Armouries through their preferred method.

Suggested Using the Loan Box Page:

Thank you for your interest in the Royal Armouries at Her Majesty's Tower of London loan box programme. The loan box is completely customisable, and correlates strongly with the requirements of the QCA curriculum. The loan box comes stocked with all non-perishable goods.

Additionally, the loan box has a variable cost associated with transporting it. Upon contacting us, we will inform you of the exact cost to get it to you.

Again, thank you for your interest and we look forward to hearing from you!

Email:
Phone:
Address:

Appendix M: Primary School Email Database (Example)

School	Contact	Email
William Bellamy Infants' School	Mrs. Phillips	office@w-bellamy-i.baraglea.org.uk
Becontree Primary School	Mr. Bradbury	office@beacontree.baraglea.org.uk
Cambell Junior School	Mr. Lucas	office@cambell-j.bardaglea.org.uk
Dorothy Barley Junior School	Mr. Dirs	office@d-barly-j.bardaglea.org.uk
Five Elms Primary School	Ms. Laider	office@five-elms.bardaglea.org.uk
Godwin Primary School	Mr. Garton	office@gascoigne.bardaglea.org.uk
Grafton Junior School	Mr. Hyde	office@grafton-j.bardaglea.org.uk
Henry Green Primary School	Ms. Peterson	office@henrygreen.bardaglea.org.uk
Hunters Hall Primary School	Miss. Nuttall	office@hunters-hall.bardaglea.org.uk
John Perry Primary School	Mrs. Harris	office@johnperry.bardaglea.org.uk
The Leys Primary School	Ms. Wiles	office@the-leys.bardaglea.org.uk
Manor Junior School	Mr. Clark	office@manor-j.bardaglea.org.uk
Marks Gates Junior School	Mrs. Hinchen	office@marksgate-j.bardaglea.org.uk
Marsh Green Primary School	Ms. Davidson	office@marshgreen.bardaglea.org.uk
William Ford CE Junior School	Miss Robinson	office@williamford.bardaglea.org.uk
William Bellamy Junior School	Mrs. Betson	office@w-bellamy-j.bardaglea.org.uk
Warren Junior School	Mr. Wilder	office@warren-j.bardaglea.org.uk
Valence Junior School	Miss Fergusson	office@valence-j.bardaglea.org.uk
Thomas Arnold Primary School	Mrs. Ritchie	office@thomasarnold.bardaglea.org.uk
Thames View Junior School	Miss Shipley	office@thamesview-j.bardaglea.org.uk
Caollindale Primary School	Mrs. Lajalati	office.collindale.barnet@lgfl.net
Coppetts Wood Primary School	Ms. Djora	office.coppettswood.barnet@lgfl.net
Courtland Primary School	Mrs. McClimont	office.courtland.barnet@lgfl.net
Cromer Road Primary School	Mrs. Schmitz	office.cromerroad.barnet@lgfl.net
Danegrove Primary School	Mrs. Metcalf	amoretti.danegrove.barnet@lgfl.net
Deansbrook Junior School	Mrs. Livingstone	info@deansbrook-jun-barnet.sch.uk
Dollis Junior School	Mr. Burns	office.dollisinr.barnet@lfel.net
Edgware Junior School	Mr. May	office.edgwarejnr.barnet@lgfl.net
Fairway Primary School	Ms. Jayasurya	office.fairway.barnet@lgfl.net
Frith Manor Primary School	Mr. Herring	office@frithmanor.barnet@lgfl.net
Garden Suburb Junior School	Ms. Bhavsar	office.gardensburbjnr.barnet@lgfl.net
Goldbeaters Primary School	Mr. Flathers	office.goldbeaters.barnet@lgfl.net

Appendix N: Secondary School Email Database (Example)

School	Contact	Email
All Saint RC Comprehensive School an	Mr. Smith	office@all-saints.bardaglea.org.uk
Barking Abbey Community School and	Mr. Llyod	office@babbey.bardaglea.org.uk
Dagenham Park Comprehensive Schoc	Mr. Torrie	office@dpcs.bardaglea.org.uk
Eatbrook Comprehensive School	Mr. Smith	office@eastbrook.bardaglea.org.uk
Eastbury Comprehensive School	Mr. Weller	headteacher@eastbury.bardaglea.org.uk
The Jo Richardson Community School	Mr. Buck	headteacher@jrcs.bardaglea.org.uk
Robert Clack School	Mr. Grant	office@robert-clock.bardaglea.org.uk
The Sydney Russell School	Mr. Leighton	office@sydeney-r.bardaglea.org.uk
Warren Comprehensive School	Mr. Lloyd	blloyd@warren.bardagkea.org.uk
Ashmole School	Mr. Brown	office@ashmole.barnet.sch.uk
Bishop Douglass RC High School	Ms. Murphy	schooladmin@bishopdouglass.barnet.sch.uk
Christ's College Finchley	Mr. Tucker	info@ccfsch.co.uk
The Compton School	Mrs. Tunnadine	office.compton.barnet@lgfl.net
Copthall School	Ms. Beaumont	enquiries@easymail.copthall.barnet.sch.uk
Eat Barnet School	Mr. Christou	enquiries@eastbarnet.barnet.sch.uk
Finschley Catholic High School	Mr. Hoare	admin@fchs.demon.co.uk
Friern Barnet School	Mr. Gosling	school@frier.barnet.sch.uk
Hendon School	Mrs. Marsh	info@hendon.barnet.sch.uk
The Henrietta Barnett School	Ms. Watts	hbs-school@btconnect.com
Holders Hill Road	Head Teacher	office.hasmonean.barnet@lgfl.net
London Academy	Mr. Hearne	office@londonacademy.org.uk
Mill Hill High School	Mr. Thompson	admin@mhchs.org.uk
Queen Elizabeth's Girl's School	Mrs. Webster	office@qegschool.org.uk
Queen Elizabeth's School, Barnet	Dr. Marincowitz	enquiries@eqbarnet.co.uk
The Ravenscroft School	Mrs. Karaolis	office.ravenscroft.barnet@lgfl.net
St. James' Catholic High School	Mrs. O'Shea	admin@st-james.barnet.sch.uk
St. Mary's CE High School	Mr. Roskell	admin@st-maryshigh.barnet.sch.uk
St. Michael's Catholic Grammar School	Miss Morrissey	office@st-michaels.barnet.sch.uk
Whitefield School	Mr. Blenkinsop	admin@whitefield.barnet.sch.uk
Darton High School	Mr. Anderson	darton.high@barnsley.org
Edward Sherrien School	Mrs. Hamby	edwardsheerienschool@barnsley.org
The Elmhirst School	Mr. Lack	elmhirst@barnsley.org.uk
The Foulstone School	Mr. King	thefoulstoneschool@barnesly.org
Holgate School	Miss Rothery	holgate@barnsley.org
The Kingston School	Mr. Millburn	kingstone@barnslety.org
Kirk Balk School	Mrs. Malcolm	kbschool@barnsley.org
Penistone Grammar School	Mrs. Gower	pgs@barnsley.org.uk
Priory School and Sports College	Mrs. O'Brien	prioryschool@barnsley.org
Royston High School	Ms. Jenkins	roystonhigh@barnsley.org
St. Michael's Catholic and Church of Er	Mr. Grabowski	stmichaelshigh@barnsley.org
Willowgarth High School	Mr. Loveday	sillowgarth@willowgarth168.freeserve.co.uk
Wombwell High School	Mr. Wilson	wombwellhighschool@barnsley.org
Beechen Cliff School	Mr. Davies	headmaster@beechencliff@bathnew.sch.uk
Broadlands School	Mrs. Ogden	enquiries@broadlands.sch.uk
Chew Valley School	Mr. Mallett	chewvalley_sec@bathnes.gov.uk
Culverhay School	Mr. Fleet	office@culverhay.bathnes.sch.uk
Hayesfield School Technology College	Ms. Draisey	hayesfield_sec@bathnes.gov.uk
Norton Hill School	Mr. Beaven	headspa@nortonhillschool.com
Oldfield School	Mrs. Sparling	headteacher@oldfied.bathnes.gov.uk
Ralph Allen School	Ms. Lee	ralphallen_sec@bathnes.gov.uk
St. Gregory's Catholic College	Mr. Friel	stgregorys_sec@bathnes.gov.uk

Appendix O: Cold-Called Teachers Email Database (Example)

Email_Schools

Teacher	Email Address
	sphilippou@sccs.camden.sch.uk
	rosannac@mixmail.com
	smith@williamellis.camden.sch.uk
	scott@williamellis.camden.sch.uk
	dazenport@williamellis.camden.sch.uk
	jwellison@hotmail.com
	ggoodsil@googlemail.com
	dcolvin@mulberry.towerhamlets.sch.uk
	success@rainsfoundataion.sch.uk
Trish	akesson@aclandburghley.camden.sch.uk
	amurtoff@aclandburghley.camden.sch.uk
Mr. Leech	info@corpuschristicollege.leeds.sch.uk
David Bedford	akedcvl1@leedslearning.net
	csg@camdengirls.camden.sch.uk
	varthur@bentleywood.harrow.sch.uk
Mr. Jones	admin@canons.harrow.sch.uk
Zaigua	zaneb@hotmail.com
	esbereton@yahoo.co.uk
	rachelroger@googlemail.com
	cstebbing@kshsonline.com